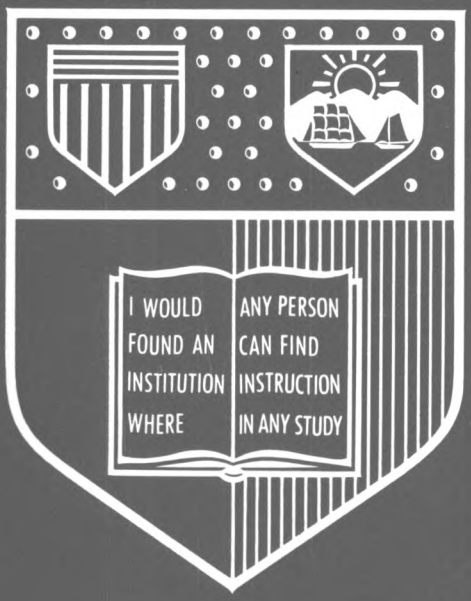
Cornell University Announcements



Graduate School

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1978–80

Cornell University Announcements

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Cornell University

Graduate School Calendar

	1978–79	1979–80
Fall		
Residence halls open	Sunday, August 27	Sunday, August 26
Registration period	Tuesday–Friday, August 29–September 1	Tuesday–Friday, August 28–31
Registration, new students	Thursday, August 31	Thursday, August 30
Registration, continuing and rejoining students	Friday, September 1	Friday, August 31
Fall term instruction begins	Monday, September 4	Monday, September 3
Thanksgiving recess		
Instruction suspended, 1:10 p.m.	Wednesday, November 22	Wednesday, November 21
Instruction resumed	Monday, November 27	Monday, November 26
Fall term instruction ends, 1:10 p.m.	Saturday, December 9	Saturday, December 8
Final examinations begin	Friday, December 15	Friday, December 14
Final examinations end	Saturday, December 23	Saturday, December 22
Spring		
Registration period	Tuesday–Friday, January 16–19	Tuesday–Friday, January 15–18
Registration, new and rejoining students	Thursday, January 18	Thursday, January 17
Registration, continuing students	Friday, January 19	Friday, January 18
Spring term instruction begins	Monday, January 22	Monday, January 21
Spring recess		
Instruction suspended, 1:10 p.m.	Saturday, March 17	Saturday, March 15
Instruction resumed	Monday, March 26	Monday, March 24
Spring term instruction ends, 1:10 p.m.	Saturday, May 5	Saturday, May 3
Final examinations begin	Monday, May 14	Monday, May 12
Final examinations end	Tuesday, May 22	Tuesday, May 20
Commencement Day	Monday, May 28	Monday, May 26

The dates shown in the academic calendar are subject to change at any time by official action of Cornell University.

In enacting this calendar, the University has scheduled classes on religious holidays. It is the intent of the University that students missing classes due to the observance of religious holidays be given ample opportunity to make up work.

Announcements

Contents

The courses and curricula described in this Announcement, and the teaching personnel listed herein, are subject to change at any time by official action of Cornell University.

Cornell University

Graduate School

The graduate program at Cornell, with its emphasis upon flexibility and independence, permits an unusual degree of accommodation to the needs and interests of the individual student. Degree requirements are kept to a minimum, and with the exception of some professional degree programs, there are no credit hour requirements.

The Graduate School is organized into eighty-three fields, or subject areas, independent of traditional college and department units. Under this arrangement, a field may draw its graduate faculty from several disciplines and departments and students are exposed to the widest range of scholarship in their respective areas of study. While the major subject is chosen from the field into which the student is admitted, minor subjects are frequently drawn from other, related fields. This further enhances the opportunity to plan a course of study that meets the specific needs of each student.

A close working relationship with faculty is essential to the graduate program at Cornell. Under the Special Committee system, the student is guided by and works with at least two or three faculty members, chosen by the student to represent his or her major and minor subjects. The major subject representative is the chairperson of the Special Committee and usually has the primary responsibility for directing the student's thesis research.

Approximately 3,500 students are enrolled in the Graduate School and are supervised by a graduate faculty numbering about 1,400. Details of the organization, regulations, and programs of study are described in the following pages.

Admission

Applicants are encouraged to communicate with individual members of the graduate faculty with whom they may want to study. Personal interviews in advance of formal application for admission are especially encouraged. For the benefit of those not acquainted with faculty members in the field or fields of their interest, each field has a graduate faculty representative who serves as director of graduate studies and to whom inquiries may be addressed.

Most students matriculate in the fall. As some fields will not accept new students for the spring term, applicants should check with the graduate faculty representative before applying for spring admission.

An applicant for admission to the Graduate School should (1) hold a baccalaureate degree granted by a faculty or university of recognized standing or have completed studies equivalent to those required for a baccalaureate degree at Cornell; (2) have adequate preparation for graduate study in the chosen field of instruction; (3) have fluent command of the English language; (4) present evidence of promise in advanced study and research; and (5) have a combined score of 1200 in the Aptitude Tests of the Graduate Record Examinations for those fields which require the GRE. Students from United States colleges and universities should be in the top third of their graduating class.

It is the policy of Cornell University actively to support equality of educational opportunity. No student shall be denied admission to the University or be discriminated against otherwise because of race, color, creed, religion, national or ethnic origin, or sex.

Cornell University is committed to assisting those handicapped students who have special needs. The University does not discriminate on the basis of handicap against qualified persons applying for admission to, or participating in, any of its programs or activities.

A brochure describing services for the handicapped student may be obtained by writing to the Office of the Dean of Students, Cornell University, 103 Barnes Hall, Ithaca, New York 14853. Other questions or requests for special assistance may also be directed to that office.

The information contained in this *Announcement* is accurate as of the publication date. For possible changes consult the Office of the Graduate School.

Categories of Admission

Degree Candidates

It is expected that most applicants for admission will pursue a program for an advanced degree. Applicants may specify candidacy for the Master of Arts, Master of Science, one of the professional master's degrees, or the Ph.D. degree. Since Cornell has a strong commitment to doctoral work most students are encouraged to enroll in a doctoral program. In some fields,

students registered in a doctoral program may be required to seek a master's degree first.

Provisional Candidates

A qualified applicant whose academic background is difficult to evaluate may be admitted as a provisional candidate. Ordinarily only one semester of study in this status is permitted, and the student who fails to qualify for candidacy at the end of that time may be requested to withdraw from the University.

Nondegree Candidates

When staff and facilities are available, the Graduate School will admit some applicants who do not intend to work toward an advanced degree at Cornell but who have special objectives for formal study or scholarly work at the graduate level, provided they satisfy all the entrance requirements expected of degree candidates. Registration as a nondegree candidate is restricted to two semesters.

Change of Status

A student who wishes to change from nondegree to degree status or from one degree or field to another, or who, after receiving the master's degree, wishes to undertake candidacy for the doctorate, must submit to the dean of the Graduate School a written request giving reasons for the proposed change. A provisional candidate is automatically reviewed at the end of the semester; no letter, therefore, is necessary.

Application Procedures

Applications for admission should be requested from the Graduate School, Cornell University, Sage Graduate Center, Ithaca, New York 14853. Letters of recommendation from two instructors who are acquainted with the applicant's work in the major area of study should be sent directly to the Graduate School. Official transcripts from all the institutions of higher learning attended and, where required, the Graduate Record Examinations or the Miller Analogies Test scores complete the application.

All applications must be accompanied by a $20 nonrefundable fee. (This fee will be $25 for spring, 1979 and subsequent semesters.)

Graduate Record Examinations

The Fields of Instruction described beginning on page 25, should be consulted for fields requiring the scores of the Aptitude Tests and the appropriate Advanced Test. Applicants should arrange to have scores sent directly to the Graduate School from the Educational Testing Service, Princeton, New Jersey 08540. Fellowship applicants are especially urged to take the GRE Aptitude Tests no later than December and to have the scores sent to the Cornell Graduate School as part of their application materials.

Students applying from institutions with S-U grading systems, particularly if they have received S-U grades in major and related subjects, are strongly urged to submit GRE Aptitude and Advanced Test scores. Without these scores there may be little useful information with which to judge admissibility.

Competency in English

Before admission can be final, all applicants whose native language is not English must provide proof of competency in the English language. Acceptable proof could be: (1) a degree from a college or university in a country where the native language is English; *or* (2) two or more years of study in an undergraduate or graduate program in a country where the native language is English; *or* (3) a TOEFL (Test of English as a Foreign Language) score of 550 or higher.

The TOEFL is offered worldwide five times a year. Information about the time and place of each of the test administrations, as well as a test application form, may be obtained by writing to the Educational Testing Service, Princeton, New Jersey 08540. The test score must be reported directly by the testing organization to the Graduate School. No final action on applications will be taken until the scores have been received.

A successful applicant whose TOEFL score is between 550 and 600 must take an English placement examination given at Cornell on the Wednesday of registration week. (Registration material will be withheld from any student in this category who does not take this examination.) If the examination score indicates that the student needs additional formal training in English, either a three- or a six-credit course will be required during the fall semester. Applicants must be prepared to fulfill—and sponsors and advisers to accept—this requirement.

It may be possible for a student receiving a TOEFL score between 500 and 550 to be accepted for the fall semester on the condition that he or she attends an intensive English course in the Summer Session *at Cornell* and continues English instruction in the fall if necessary. Applicants who attend English language programs elsewhere must submit a minimum TOEFL score of 550 to be admitted to the Cornell Graduate School.

Under certain circumstances, if it is impossible to arrange to take the TOEFL in sufficient time, an ALIGU (American Language Institute Georgetown University) test score of 85 or higher may be accepted in lieu of the TOEFL. This arrangement, however, is discouraged. All applicants submitting an ALIGU score must take the Cornell English placement examination before being permitted to register.

Financial Aid

The application for admission to the Graduate School also serves as an application for financial aid. Applicants indicate the type(s) of support for which they wish to be considered by answering the pertinent questions.

Application Deadline

Although applications for admission to the Graduate School may be submitted at any time throughout the

year, many fields require that completed applications be received by January 15. Foreign students should complete their applications as early as possible to allow time for the admissions office to evaluate financial support and to issue certificates of eligibility for visas.

Applicants for fall admission who are also applying for fellowships *must* submit their applications and all supporting documents by January 15.

Notification of Admission and Financial Aid

If application is made for the fall term and supporting documents are received by January 15, every effort will be made to notify the applicant of admission action no later than May 1.

As agreed upon by some of the members of the Council of Graduate Schools in the United States, *successful* fellowship applicants will be notified of their award by April 1. It is not possible to inform other applicants of the outcome of the fellowship competition.

Applicants awarded other forms of financial support will hear directly from the fields to which they have been admitted.

Tuition and Fees

The Bursar's Office mails statements at the beginning of each month to the address designated by the student for those students who incur charges and for those who have amounts due the University.

Tuition is billed on a per-term basis approximately one month before the beginning of each term. Charges not billed on the first statement will appear on a subsequent monthly statement.

All charges are payable in full within twenty days of the billing date. Any amounts remaining unpaid, in whole or in part, after the due date of the statement on which the charges first appeared will be assessed a finance charge at the rate of 1 percent per month (12 percent annual interest rate).

An individual who has outstanding indebtedness to the University will not be allowed to register or re-register in the University, receive a transcript of record or receive a degree.

The amount, time, and manner of payment of tuition, fees, or other charges may be changed at any time without notice.

Registration Fee Every applicant accepting admission who has not previously matriculated at Cornell must pay a $50 registration fee. This fee will not be refunded to any student who withdraws after May 10 or later than twenty days after the date of the acceptance notice. The registration fee is not covered by University fellowships, scholarships, or assistantships.

Tuition

Graduate School tuition varies according to the student's area of study. If the chairperson of the student's Special Committee (see p. 9) has an appointment in one of the following statutory colleges—College of Agriculture and Life Sciences, College of Human Ecology, the School of Industrial and Labor Relations—the tuition charge is $2,200 for the academic year. If the Special Committee Chairperson is in the College of Veterinary Medicine, tuition is $2,800. When the chairperson of the Special Committee is in one of the endowed colleges—College of Arts and Sciences, College of Engineering, School of Hotel Administration, the Law School, College of Architecture, Art, and Planning, and the Graduate School of Business and Public Administration—the tuition charge is $4,400. Students in the Division of Biological Sciences, which includes both endowed and statutory units, pay the statutory tuition, as do students in the M.A.T. program.

It should be noted that these tuition charges are for the 1977-78 academic year; increases are anticipated for the 1978-79 academic year.

Any student who is to receive less than full residence credit because of employment should apply for proration of tuition on forms procurable at the Graduate School Office. Tuition is based on residence eligibility (see pp. 10-11).

A special tuition rate of $400 a term has been established for students who have satisfactorily completed four or more years of study at Cornell in the same Ph.D. program, who have no support or other financial aid from the University, who have passed their admission to candidacy examination, and who are not taking courses or making use of classroom or laboratory facilities.

Refunds

Part of the amount personally paid for tuition will be refunded if the student obtains an official certificate of leave of absence or withdrawal from the Graduate School. Students who terminate their registration in the University during a regular term in this manner will be charged tuition from the registration day to the effective date of the certificate as follows: first week, 10 percent; second week, 20 percent; third week, 30 percent; fourth week, 40 percent; fifth week, 60 percent; sixth week, 80 percent; seventh week, 100 percent. No charge will be made if the effective date of leave or withdrawal is within the first six days of the term, including registration day.

The University makes available tuition insurance which provides refunds in the event of leave of absence or withdrawal for medical or emotional reasons. Complete details regarding this coverage and applications accompany the August tuition bill.

Summer Session Tuition

Graduate students who attend classes in the Summer Session must register both in the Graduate School and in the Summer Session. They pay the tuition and fees listed in the *Announcement of the Summer Session*. Students who register for residence credit for summer research are charged by the fraction of the residence unit to be earned, based on the subsequent year's tuition.

Students who register for summer research on a non-credit basis (NCGR) do not pay tuition or fees if they have been in residence for at least one semester in

the preceding academic year. Those who have not been in residence in the preceding year and who register NCGR pay a fee of $5 per week.

Other Fees

Candidate for Degree Only. A graduate student who returns to the University to present a thesis and to take the final examination for an advanced degree, all the work for that degree having been previously completed, must register as a Candidate for Degree Only and pay a fee of $35.

Thesis Fee. Each doctoral candidate must pay $40 when the approved thesis and abstract in final form are deposited. This fee covers the cost of preparing a master microfilm of the entire thesis; of publishing the abstract in the monthly periodical *Dissertation Abstracts International;* of mailing the microfilm and abstract to the microfilm publisher; and of binding both copies of the thesis for deposit in the University Library.

In Absentia. A graduate student registered *in absentia* pays a fee of $75 each term.

Financial Aid

(See application and notification procedures on pp. 6-7)

Extensive financial resources are available to help Cornell graduate students with educational costs. In recent years, more than 80 percent of the graduate students received financial aid, either from Cornell fellowships, teaching assistantships, and research assistantships or from outside sources. But, with sharply diminishing outside support, the number of students with fellowships or assistantships is expected to decrease. Since the demands of graduate study are so great, students are discouraged from trying to support themselves by unrelated employment.

Applicants are reminded that financial aid awards normally are made on an academic year basis, and it is unlikely that students entering in the spring semester would receive financial assistance for that term.

Fellowships

Fellowships are awarded to full-time students who are candidates for a higher degree (usually a Ph.D.) primarily on the basis of scholastic ability and promise of achievement. The holder of a fellowship may accept no other concurrent appointment or employment without permission of the Cornell Graduate Fellowship Board. More than 300 fellowships are under the direct supervision of this board or of academic units of Cornell. The following Cornell fellowships are available to first-year students: Andrew D. White Fellowships ($3,500), Cornell Graduate Fellowships ($3,000), fellowships from special endowments ($1,000 to $3,000), and industrial fellowships ($1,500 to $3,000). Most of these also provide tuition awards. Candidates for Cornell fellowships are nominated by the field from among those students applying.

Prospective graduate students should also consider applying for outside fellowships from foundations, industrial concerns, and national, international, or government agencies. Students receiving a Cornell fellowship and an outside award may be permitted to hold both concurrently although an adjustment may be made in the Cornell award.

Minority Group Fellowships

Cornell has recently made money available for fellowships for minority applicants who are not offered support through other channels. These are for one academic year. The student does not apply for these fellowships directly but is nominated by the field granting admission

FLAS (formerly NDFL) Fellowships

Applications for National Defense Education Act Title VI (FLAS—Foreign Language and Area Studies) Fellowships are available at the Fellowship Office, 116 Sage Graduate Center. The purpose of the FLAS program is to provide encouragement to individuals taking advanced training in languages and in associated area studies designated as being of critical importance to the United States.

Assistantships

Applicants interested in teaching or research assistantships should indicate this fact on the Graduate School application form and should also write directly to the graduate faculty representative in the field of interest.

Teaching Assistantships

An appointment as a teaching assistant is usually in the student's major field or in one that is closely related. The duties ordinarily require less than twenty clock hours of the student's time a week, depending on the field. A teaching assistant whose duties are in the major field of interest and do not exceed twenty hours a week is eligible for full residence credit.

Research Assistantships

The duties of a research assistant involve work on a research project. The student is usually required to work fifteen to twenty hours a week, and full residence credit can be earned if the research is in the field of major interest.

Graduate Research Assistantships

A student whose research interest coincides with a supported research project may receive a graduate research assistantship with the understanding that thesis research will contribute to, and be appropriate for, the project. No time commitment is specified, but since a student devotes considerable time to thesis research, the amount of time spent on this work is expected to be great.

Incoming graduate students holding teaching or research assistantships are usually awarded a tuition fellowship plus $3,200 or $3,700 for the academic year, depending on the hours of work required. First-year graduate research assistants usually receive an amount that will cover tuition and $2,900 for a nine-

month appointment. Additional summer awards may be made.

Residence Hall Assistantships

Approximately twenty-five assistantships are available for single or married graduate students who wish to apply for the head resident position in an undergraduate or graduate residence hall. Students in any field are eligible to apply but these positions are most appropriate for students who would like experience working with undergraduate students and University staff.

Remuneration includes a partial tuition grant, a board supplement, and a stipend which varies according to responsibilities. Since applicants must participate in a lengthy selection process on campus, positions are not generally available to first-year graduate students. A personal interview is required of all applicants. Application forms and details about residence hall assistantships may be obtained from the office of the Dean of Students, Barnes Hall.

Other Support

Prizes

Several University prizes are open for competition to graduate students. A booklet, *Prize Competitions*, which describes all regularly established prizes, may be obtained from Mrs. Jean Morehouse, Office of the Dean of Faculty, 315 Day Hall.

Tuition Assistance Program (TAP)

Students who are legal residents of New York State may be eligible for the Tuition Assistance Program. Information and application forms may be obtained from New York State Higher Educational Services Corporation, Student Financial Aid Section, Tower Building, Empire State Plaza, Albany, New York 12255. (Students who receive tuition awards from Cornell are required to apply for the Tuition Assistance Program if eligible; the Cornell award will be reduced by the amount of the TAP award.)

Loans

Only graduate students who are registered as degree candidates are eligible for loans. Applications for the National Direct Student Loan Program and for University loans are available at the Office of Financial Aid, 203 Day Hall. Applications should be submitted by March 1 for the following fall semester. Increasingly, the University is referring both undergraduate and graduate students to their respective state loan programs. Applications for these programs may be obtained from the student's home bank.

Part-Time Employment

Opportunities for part-time work are often available in connection with departmental research projects or other activities. Applications for such work should be made directly to the department concerned or to the Student Employment Office, Day Hall. Candidates may find of value employment in research or other work closely allied to their academic interests; on the other hand, progress in candidacy is difficult when students attempt to support themselves wholly or partially by work unrelated to their studies.

Employment for Spouses of Students

Some nonacademic positions for students' spouses are available at Cornell University through the Personnel Department, B-12, Ives Hall.

In addition, the Ithaca area offers employment in small industrial plants, at Ithaca College, in the local hospital, and with various businesses. For further information applicants should consult the New York State Employment Branch Office located in the Cornell Personnel Office, B-12, Ives Hall.

Degree Requirements

Degree requirements of the Graduate School are kept at a minimum in order to give the student maximum flexibility in choosing a program of study. Since progress in graduate study depends so much on the individual student's situation, no credit hour or grade requirements are imposed by the Graduate School. Grades of C+ and below, however, do not normally constitute satisfactory progress for a student enrolled in the Graduate School.

The Special Committee

The Graduate School is organized into fields of study, independent of colleges and departments. A student is admitted to a specific field and selects a major subject from among those listed under that field in this *Announcement*. Minor subjects may be chosen from the field and other related fields and areas of concentration.

The student's program is developed with the aid and direction of the Special Committee, which is composed of members of the graduate faculty chosen by the student to fit his or her particular needs and interests.

The Special Committee for a Master of Arts or a Master of Science candidate is composed of a chairperson, who represents the major subject, and one representative of a minor subject. The Special Committee of a doctoral student is composed of a chairperson, representing the major subject, and two other members from other areas of interest. The chairperson of the Special Committee usually directs the student's thesis research. Most fields require two minor subjects for doctoral programs, but some require only one. All Ph.D. Special Committees have at least three members.

A student may ask any member of the graduate faculty in his or her field to serve as chairperson and to represent the major subject. The chairperson, in turn, advises the student about minor subjects and graduate faculty members who might represent them on the student's Special Committee. It is the privilege of a faculty member to decline to serve on an individual's Special Committee.

The choice of major and minor subjects and the formation of the Special Committee must be recorded in

the Graduate School within two weeks of the beginning of residency. In some of the larger graduate fields, where it may be difficult for a new student to make a wise selection of committee members, the graduate faculty representative or other faculty member may serve temporarily as the chairperson until the student forms a permanent committee. Students are encouraged to change the membership of their Special Committee as their aims become more definite. A change of committee must be reported on the Change of Special Committee form supplied at the Graduate School Office. A change in Special Committee after four units of residence requires the approval of the General Committee of the Graduate School.

The members of the Special Committee direct the student's program and decide whether satisfactory progress toward the degree is being made. They conduct and report on oral examinations and they approve the thesis. While the committee and the student constitute an independent working unit, all members of the graduate faculty are free to participate in the scheduled examinations and to review the theses of candidates for degrees.

Residence

The graduate faculty regards study in residence as essential. Although students working off campus may become proficient in a technique or even in a field of knowledge, they may fail in other ways to attain the breadth of knowledge necessary for scholarly work. In addition to use of the libraries and physical facilities of the University, students need persistent and continuing interaction with others engaged in similar pursuits. Attendance at lectures, seminars, and other academic meetings on campus is also an important part of graduate education.

All candidates for a graduate degree must remain in residence at Cornell for a specified number of residence units. One semester of full-time study at an acceptable level of performance constitutes one residence unit. Candidates for the M.A. or M.S. degree normally take between one and two years of satisfactory full-time study to complete all the degree requirements. A minimum of two residence units must be earned before the degree is granted. Candidates for the Ph.D. degree normally take four or five years of satisfactory full-time study to complete all the degree requirements. A minimum of six residence units must be earned before the degree is granted.

A student in a master's program may earn no more than one unit, and a student in a doctoral program no more than two units, for all work done in Summer Session, Summer Research, and the Division of Extramural Courses. At least four of the six units required for the Ph.D. degree must be earned as a full-time student, earning three quarters of a residence unit or more each term. Two of the last four units must be earned in successive terms of full-time study on the Cornell campus.

A student must complete all the requirements for the master's degree in four years from the date of first registration in the Graduate School; a maximum of seven years is allowed for completion of the doctoral degree.

All students using University facilities must register and must pay tuition until the completion of their program unless they withdraw or are granted a leave of absence.

Transfer of Residence

A candidate for the master's degree may not count study in other graduate schools as part of the residence. A candidate for the doctorate may be permitted to count study for the master's degree, if it is relevant to the doctoral program, as equivalent to two residence units. No commitment regarding transfer of residence may be made until after the student has entered into residence and the Special Committee has had opportunity to judge the student's accomplishments. The residence transferred must not exceed that which would have been earned under similar circumstances at Cornell, and no credits will be allowed for study as an undergraduate or as a special student.

Summer Session

To receive residence credit for a summer session, the candidate must register in both Summer Session and the Graduate School and must file a statement of courses satisfactory to the Special Committee. A student may, with prior approval of the Special Committee, earn one-half of a residence unit by completing eight credits or more in the eight-week session, or two-fifths of a unit for six credits or more in the six-week session. Residence may be transferred for study during one summer session preceding registration in the Graduate School if this study is an integral part of the graduate program subsequently undertaken, and if the transfer is recommended by the student's Special Committee and approved by the dean of the Graduate School.

Summer Research

To receive residence credit for summer research, students need register with the Graduate School only. Graduate students may also register for summer research on a noncredit basis (NCGR) (see p. 7).

Summer registration (a valid summer ID) is necessary for all students who wish to use the Gannett Clinic and the libraries, certify G.I. Bill benefits, or establish foreign student certification.

Part-Time Studies

Essentially all graduate students at Cornell are full-time students. If employment is necessary, students may hold positions requiring up to ten hours of work each week without reduction of residence credit. Teaching and research assistants whose duties require up to twenty hours a week are eligible for full residence credit.

Part-time employees are eligible for residence units as follows.

Employment Residence Units Allowable Each Semester

Total clock hours each week	Contributory in major field; on campus	Noncontributory; on campus	Off-campus
0-10 hours	1 unit	1 unit	1 unit
11-20 hours	1 unit	¾ unit	¾ unit
21-30 hours	¾ unit	½ unit	(see below)

Those employed for more than twenty clock hours each week off campus, or more than thirty clock hours each week under any circumstances, may earn a maximum of two-fifths of a residence unit a semester through registration in the Division of Extramural Courses, but this will be permitted only on the basis of petition approved before the work is undertaken.

Students enrolled in the Division of Extramural Courses are not considered to be registered as graduate students, but may accumulate residence units. Fifteen credits completed through the Division of Extramural Courses are equivalent to one residence unit, and six credits are equivalent to two-fifths of a unit—the smallest fraction that will be recorded by the Graduate School toward fulfillment of residence requirements. Detailed information concerning extramural courses and registration procedures may be obtained from the Division of Extramural Courses, 105 Day Hall.

Information about a part-time master's program for established Ithaca residents may be obtained from the Graduate School Office.

Examinations

The Special Committee conducts the examinations required for the degree. At the discretion of the Special Committee these examinations may be oral or oral and written. The examination must be scheduled at least seven days in advance in the Graduate School Office. A final examination is required for the master's degree and under certain conditions may be combined with the admission to (Ph.D.) candidacy examination.

Two examinations are required for the doctoral degree. The comprehensive admission to candidacy examination for formal admission to doctoral candidacy may be taken after a student has earned at least two units of residence credit. This exam must be passed before seven residence units have been accrued and at least two units must be earned after completing the exam. The final examination, given after completion of the doctoral dissertation, covers subject matter related to the dissertation topic.

In some fields a qualifying examination is given at an early date to determine the student's fitness for advanced study and to help the Special Committee plan a program of study.

In fields that so desire, the Special Committee may, after the admission to candidacy examination has been taken, nominate the student for a special master's degree without the requirement of a thesis, provided that the student does not already hold such a degree granted by another institution. The master's degree may be given whether or not the admission to candidacy exam for the Ph.D. has been passed; it is awarded after the completion of four units of residence.

Foreign Language Requirements

Each field has its own foreign language requirements which it considers most useful to the particular area of study. Any Special Committee may, at its discretion, require knowledge of foreign languages beyond the announced requirements.

Courses designed to aid graduate students in learning to read French, German, Russian, and Spanish are given by the Department of Modern Languages and Linguistics in cooperation with the graduate faculty.

Thesis

Candidates for the degree of Master of Arts or Master of Science are required to submit a thesis in fulfillment of the requirements for the degree (except for the special master's as described above). Some fields also require a thesis for professional master's degrees. Candidates for the doctoral degree must complete a thesis which constitutes an imaginative contribution to knowledge. The faculty requires publication of Ph.D. theses by abstract and microfilm.

General Information

Living Arrangements

Further information about and application forms for the University housing described below, may be obtained from the Housing Assignment Office, 223 Day Hall.

Dormitory Accommodations Sage Graduate Center has dormitory facilities accommodating approximately 190 men and women. Cascadilla Hall has accommodations for approximately 160 men and women. Thurston Court Apartments has single and double apartments for 26 graduate men and women.

Family Accommodations The University has three apartment developments for student families. They are Cornell Quarters, Pleasant Grove Apartments, and Hasbrouck Apartments, with housing for a total of 420 families. All apartments are unfurnished.

Off-Campus Housing The Housing Assignment Office maintains a board with voluntarily listed accommodations. Because available accommodations change constantly, it is not practical to mail listings, nor is it feasible to maintain a waiting list of persons seeking accommodations. A booklet which details off-campus housing in the Ithaca area is available upon written request to the Housing Assignment Office.

Health Requirements on Entrance

Each entering graduate student must submit a health history, on the form supplied by the University. Tetanus immunization, while not required, is strongly advised; either primary or booster immunization may be obtained at the Gannett Clinic at a nominal charge. A student who is returning to the campus after more than one year's absence must submit an interim health history. Failure to fulfill the health requirements may result in loss of the privilege of registering the following term.

Health Services and Medical Care

Health services and medical care for students are centered in two Cornell facilities, the Gannett Medical Clinic (outpatient department) and the Sage Infirmary.

Students are entitled to unlimited visits at the clinic. Appointments with individual doctors at the clinic may be made by calling or going there in person. An acutely ill student will be seen promptly with or without an appointment. Students are also entitled to routine laboratory and X-ray examinations indicated for diagnosis and treatment, medical care in the Sage Infirmary for a maximum of fourteen days each term, short-term mental health care, and emergency care. If a student prefers to consult a private physician rather than go to the clinic, or to have the services of a private doctor while a patient in Sage Infirmary, the cost must be borne personally.

In order to protect the student while on vacation or for hospitalization in Ithaca, Cornell has a health insurance plan to supplement the services outlined above. (This plan may be waived if the student has other health insurance.) Information about this insurance may be obtained at the Gannett Clinic from the insurance company representative. Spouses of regularly enrolled students may use the University health services on a fee-for-service basis. Additional information may be obtained at Gannett Medical Clinic.

Motor Vehicles

The University requires that *all* members of the campus community register with the Traffic Bureau at 115 Wait Avenue any vehicles (including cars, trucks, motorcycles, and motorscooters) owned or operated by Cornell community members which are at *any time* parked on the Ithaca campus.

A complete listing of parking and traffic regulations is to be found in the pamphlet, *Cornell University Regulations Governing Motor Vehicles*, available at the time a vehicle is registered.

The Traffic Bureau will be glad to assist with general inquiries, special problems, and requests. Correspondence should be directed to the Traffic Bureau, Cornell University, 115 Wait Avenue, Ithaca New York 14853, telephone 607/256-4600.

Activities for Graduate Students

Cornell students enjoy the advantages of a small academic community while having access to many cultural events that rival those of any large city. Lectures, movies, dramatic productions, special art exhibitions, and concerts fill the University's weekly calendar. The Bailey Hall Concert Series brings internationally famous artists and orchestras to Ithaca.

Many graduate students participate with undergraduates in extracurricular activities such as intramural sports, Glee Club, Sage Chapel choir, publications, music, and folk dancing. A Graduate Student Activities Committee is active in scheduling weekly social events. A Graduate Wives' Club promotes activities for the wives of graduate students. Willard Straight Hall and the Sage Graduate Center provide facilities for graduate groups and aid in planning special functions for them. Cornell United Religious Work, located in Anabel Taylor Hall, serves as an information and referral agency for the varied religious activities that take place on campus. Seventeen religious groups together form a Council of Federated Ministries, with chaplains and faculty advisers who are available for counseling graduate students. The Centre for Religion, Ethics, and Social Policy, also headquartered in Anabel Taylor Hall, is open to graduate students.

Cornell's location in the Finger Lakes Region of New York State encourages outdoor activity. Many swimming and boating facilities are available. In addition, Cornell operates a private eighteen-hole golf course; indoor swimming facilities; an indoor skating rink; tennis, handball, and squash courts; several gymnasiums; and riding stables. A number of ski resorts also operate nearby.

Counseling

The University maintains a variety of counseling services available to graduate students. A student's primary academic counselors are the members of his or her Special Committee. Other counselors who are able to help in matters of various kinds will be found in the Office of the Dean of Students, the Office of Admissions and Financial Aid, the International Student Office, the Sage Graduate Center, the Gannett Medical Clinic, and the Cornell United Religious Work Office in Anabel Taylor Hall.

International Student Office

Cornell has, since its founding, welcomed students from abroad. Currently about 1,140 foreign students representing 96 countries are pursuing study in a variety of fields. Approximately 820 of the foreign students are enrolled in the Graduate School.

The International Student Office is located in 200 Barnes Hall. Students from abroad must report to this office upon arriving in Ithaca and are invited to consult the staff at any time concerning questions they may have. This office also works closely with academic advisers and sponsors, and with persons involved in a variety of student and community programs that enrich the cultural life of Cornell.

Ithaca families participate in a Host Family Program where foreign students are invited to share in some aspects of American family life in the community. Ithaca, because of the University, tends to have a more cosmopolitan atmosphere than most other

small cities, and a student can usually find an outlet for a wide variety of interests.

The Career Center

The Career Center at 14 East Avenue (in Sage Hall) is a resource and information center for jobs in business, industry, government, and teaching. Information is also available for graduate programs leading to the professions, for fellowships, and for summer experiences (work, study, travel, service projects). Students and faculty may keep up to date on the activities of the center by watching for the *Career Center News* in the Tuesday edition of the *Cornell Daily Sun*. The center also provides an alumni placement service.

Advanced Professional Degrees

Advanced professional degrees are designed as preparation and training for specific professions. The admissions procedures, requirements, and curricula for such degrees, as approved by the graduate faculty, are announced by the faculty of a professional school or college, which, for this purpose, acts as a division of the graduate faculty. Degrees are awarded upon recommendation of the division to the graduate faculty. Detailed information regarding admission or academic requirements for any professional degree is included in the *Announcement* of the separate school or college in which the degree is offered. Inquiries addressed to the Graduate School will be forwarded to the proper official. The professional degrees listed below are approved by the graduate faculty.*

Africana Studies

Master of Professional Studies (African, Afro-American) [M.P.S. (A.A.A.)] The program leading to this degree is intended to prepare students for teaching, research, and other professional careers related to black studies. Degree requirements include thirty hours of course work (or equivalent), at least one year in residence, and the completion of a master's thesis. Detailed information may be obtained from the Africana Studies and Research Center, 310 Triphammer Road.

Agriculture

Master of Professional Studies (Agriculture) [M.P.S. (Agr.)] This degree is intended for professional agriculturists seeking opportunity to study in depth or in breadth some subject or problem that is pertinent to their profession. Graduate students interested in the M.P.S. (Agr.) degree may select from among the following fields: agricultural economics, agricultural engineering, agronomy, animal science, education, entomology, floriculture and ornamental horticulture, food science, international agricultural and rural development, natural resources, plant breeding, plant pathology, pomology, poultry science, rural sociology, vegetable crops. Detailed information may be obtained from Director J. Robert Cooke, 192 Roberts Hall.

Architecture, Fine Arts, City and Regional Planning

The following three degrees are administered by the Division of Architecture, Art, and Planning of the Graduate School. Inquiries should be addressed to the department chairperson.

Master of Architecture [M.Arch.] Training is provided in architectural design, urban design, and regional design. Only graduates of a professional program in architecture are admitted as candidates. Others may be admitted as noncandidates or as undergraduate transfers and will be required to complete additional course work before application for admission to the degree program.

Master of Fine Arts [M.F.A.] Advanced training is provided in the practice of painting, sculpture, or graphic arts.

Master of Regional Planning [M.R.P.] Training is provided for a professional career in the field of planning; in the public sector at the city, regional, or national level.

For the Master of Landscape Architecture, see p. 15.

Communication Arts

Master of Professional Studies (Communication Arts) [M.P.S.(C.A.)] The focus of this program is more on the *strategic application* of communication knowledge and technology than on technical competence in media operation. The curriculum is designed for those students who wish to work with agencies in which organized public communication is a key concern. Emphasis is placed on three key elements: (1) analysis of what is known about the communication process; (2) exploration of the potential of current and new communication techniques and technology; and (3) application of the first two elements to specific communication problems.

Education

Master of Arts in Teaching [M.A.T.] The program for this degree is designed for and limited to those preparing for teaching the following subjects in secondary schools: agriculture, English, and home economics. The student and the Special Committee will select those courses and seminars in the teaching

* The following are advanced degrees that are also first degrees of a school or college and therefore are not subject to the jurisdiction of the graduate faculty. For information regarding these degrees, address the school or college indicated.

Master of Business Administration, Master of Public Administration, Master of Professional Studies (Hospital and Health Services Administration): Graduate School of Business and Public Administration
Doctor of Law: Law School
Doctor of Medicine: Medical College, New York City
Doctor of Veterinary Medicine: College of Veterinary Medicine

specialty and in education that are deemed most appropriate for developing competence as a teacher. The student will be required to demonstrate teaching skill in a supervised field experience. Completion of two regular semesters and one summer of full-time study, or two and two-fifths residence units is required. Graduates of a teacher-training program are not eligible for this degree.

Doctor of Education [Ed.D.] The program for this degree is designed to prepare candidates within a broad cultural context for positions of professional leadership in education. The program of studies must include advanced work in each of the following: educational psychology, history or philosophy of education, educational measurement and statistics, and research in education. A minimum of sixty-five credits beyond the bachelor's degree is required, of which thirty-five should be completed beyond the master's degree or its equivalent. A candidate is required to complete a minimum of five residence units beyond the bachelor's degree and a year of directed field experience.

Engineering

Master of Engineering [M.Eng.] Graduates intending to prepare for professional engineering careers generally seek the professional degree of Master of Engineering. At Cornell this one-year program is integrated with the undergraduate engineering program; after receiving their baccalaureate degrees, many students apply to continue for the fifth year in a specific engineering field. Applications from engineering and applied science graduates from accredited programs or their equivalent of other institutions are also encouraged. Upon completion of the program, students can either begin the practice of engineering or applied science or elect to apply for further graduate training in an appropriate Ph.D. program.

The degree may be taken in any of eleven areas: engineering mechanics; engineering physics; operations research and industrial engineering; or aerospace, agricultural, chemical, civil, electrical, materials, mechanical, or nuclear engineering.

The professional degree requires a minimum of thirty credits of graduate-level work in the principles and practices of the specific field. A thesis is not required, but an engineering design project (that may be worked on individually or in groups) must be completed and a formal report on the project submitted. The program also requires completion of a curriculum of related technical courses, differing in content among the several professional fields. Each curriculum includes some prescribed and some elective courses, with considerable flexibility to permit adaptation to the special needs of the individual student. This program is generally completed in one academic year, but can be extended upon request to include the following summer term.

While there is no specific deadline for the receipt of applications, early submission (by November 15) is recommended, especially if the candidate wishes to apply for financial aid. Application forms are available through the various program representatives or from the Office of the Graduate Professional Engineering Programs, 319 Upson Hall.

English

Master of Fine Arts [M.F.A.] The degree of Master of Fine Arts in creative writing is designed to prepare candidates for careers in professional writing or in the teaching of creative writing. The program is administered by a specially appointed committee of the Department of English, acting as a division of the Graduate School.

Food Science and Technology

Master of Food Science [M.F.S.] This program is designed for students who hold a four-year engineering degree and want preparation for work in the food industry. Further information may be obtained from Professor W. K. Jordan, 106 Stocking Hall.

Hotel

Master of Professional Studies (Hotel Administration) [M.P.S.(H.Ad.)] This degree is available to students who already possess a bachelor's degree in an area other than hotel administration. It also allows students with a B.S. in hotel administration to continue on a more professionally oriented and less research inclined level than the Master of Science. The mode and curriculum for completing this program vary according to areas previously studied. For further information see p. 57 or write to the Graduate Faculty Representative, School of Hotel Administration, Statler Hall.

Human Ecology

Master of Professional Studies (Human Ecology) [M.P.S.(Hu.Ec.)] This degree is intended for practicing professionals in human ecology-related areas who want further study in a subject or problem area pertinent to their profession, but who are not necessarily interested in a research degree. Applicants may apply for the M.P.S.(Hu.Ec.) degree in any of six fields associated with human ecology—consumer economics and housing, design and environmental analysis, education, human development and family studies, human service studies, and nutrition—or for an interdepartmental program of studies in human ecology. Degree requirements include a minimum of two residence units (one of which must be earned during the academic year), completion of thirty credits including a problem-solving project, and a final oral examination. Detailed information may be obtained from the Office of Graduate Education, N-116 Martha Van Rensselaer Hall.

Industrial and Labor Relations

Master of Industrial and Labor Relations [M.I.L.R.] The four-semester program leading to this degree provides a basic course of graduate study for those with professional interests in industrial and labor relations and further provides limited opportunities for specialized professional study where broad competence has been established. This degree is

administered by the Division of Industrial and Labor Relations of the Graduate School. Students possessing a law degree may be eligible for a two-semester M.I.L.R. program. More information may be obtained by writing to the Graduate Faculty Representative, School of Industrial and Labor Relations, Ives Hall.

International Development

Master of Professional Studies (International Development) [M.P.S.(I.D.)] This degree program provides an interdisciplinary course of study for experienced practitioners in international development who seek to upgrade substantive and analytic skills in areas of specific relevance to their professional careers. The course of study consists of at least thirty credits, including an applied research project. Ordinarily students will divide their course work between methods of analysis, such as development administration and planning, development economics, development politics, development sociology, or international communication, and one of the following substantive concentrations: population, regional planning, science and technology policy, and nutrition. Further information is found on page 61 of this *Announcement*, and a descriptive brochure may also be obtained from the Center for International Studies, 170 Uris Hall.

Landscape Architecture

Master of Landscape Architecture [M.L.A.] Professional training in the areas of land planning and design. Individuals with an undergraduate degree in design (including architecture), landscape architecture, city planning, and environmental design may be admitted as candidates. See page 62 for a more detailed description.

Law

The following two degrees are administered by the Division of Law of the Graduate School. The *Announcement of the Law School* should be consulted for a complete description of the program and requirements.

Master of Laws [LL.M] This degree is intended primarily for students who desire to increase their knowledge of the law by working in a specialized field.

Doctor of the Science of Law [J.S.D.] This degree is intended primarily for the student who desires to become a proficient scholar by original investigation into the functions, administration, history, and progress of law.

Music

Master of Fine Arts [M.F.A.], Doctor of Musical Arts [D.M.A.] These two degrees are appropriate for mature composers who seek further professional training as well as knowledge of the other arts and humanities, both to enrich their creative perspectives and to prepare them for the teaching of composition and theory at the university level. The degrees are administered by the Department of Music, acting as a division of the Graduate School for this purpose. More information may be obtained from Professor Robert M. Palmer, 218 Lincoln Hall.

Theatre Arts

Master of Fine Arts [M.F.A.] The degree of Master of Fine Arts in theatre arts is intended for students who wish to increase their professional competence as actors, designers, and directors through a studio-oriented program. It is administered by the Department of Theatre Arts, acting as a division of the Graduate School for this purpose.

Veterinary Medicine

Doctor of Science in Veterinary Medicine [D.Sc. in V.M.] This degree is characterized by a professional rather than a general research objective, and it is designed especially for experienced persons in the basic and clinical sciences who need more specific, advanced, scientific, and professional knowledge in order to equip themselves for careers in teaching and research. This degree is administered by the Division of Veterinary Medicine of the Graduate School.

Graduate School of Medical Sciences

The Graduate School of Medical Sciences has the full responsibility for administrative matters related to the advanced general degrees granted for study in residence at the New York City campus of Cornell University. The general degrees of Ph.D. and M.S. are awarded in the Fields of Biochemistry, Biological Structure and Cell Biology, Biology, Biomathematics, Biophysics, Genetics, Microbiology, Neurobiology and Behavior, Pathology, Pharmacology, and Physiology. (See p. 66.)

The facilities for graduate work at the Graduate School of Medical Sciences include the lecture rooms, student laboratories, library, and research facilities of the Medical College and of the Sloan-Kettering Division. The graduate programs in the Medical College Division provide degree candidates whose career goals are research and teaching in the basic medical sciences with an excellent opportunity for direct involvement in these fields. The special facilities and experienced investigators of the Sloan-Kettering Division offer ample opportunity for advanced graduate work in the basic science aspects of research related to cancer and allied diseases.

Teaching fellowships and research assistantships are available. Information on other financial assistance and the entire program of the Graduate School of Medical Sciences is given in the *Announcement of the Graduate School of Medical Sciences*, which may be obtained from the Graduate School of Medical Sciences, Cornell University Medical College, 1300 York Avenue, New York, N.Y. 10021.

Cornell University Libraries

The University's libraries offer support for graduate studies at several levels. They provide basic readings

in virtually all subjects, collateral studies for classroom and seminar instruction, and highly specialized materials for advanced students. The total number of volumes at Cornell is now more than four million and that figure increases by about 150,000 each year. An unusually rich collection of reference works, both modern and antiquarian, expedites both daily study and dissertational research. About 50,000 journal and periodical titles are available, most of them in complete runs, some of them in multiple copies, all of them immediately available. Special services are maintained for maps, microtexts, documents, newspapers, and other such collections.

Though there are many college, school, and department libraries on the campus, it is Olin Library, designed primarily as a research library, which becomes the most familiar to graduate students. Completed in 1961, it is designed to offer easy access to the book stacks, card catalogs, and photocopying facilities; it also provides a lounge area for graduate students and faculty. A graduate student may apply for the use of a carrel in order to facilitate completion of his or her dissertation.

Within Olin are a number of special collections likely to be of particular interest to advanced students of the social sciences and the humanities. The Department of Rare Books houses several distinguished collections, among them books and manuscripts relating to Dante, Petrarch, Wordsworth, Joyce, Shaw, and other literary figures. The Noyes Collection is rich in American historical documents, especially those pertaining to Lincoln and the Civil War. Students in the social sciences will also find extraordinarily interesting manuscripts and books in the collections of slavery and abolition, of witchcraft, of the French Revolution, and of the life and times of Lafayette. Long familiar to professional scholars are the Wason Collection on China, Japan, and Southeast Asia, and the Old Icelandic Collection. The history of science collections include the Adelmann Library of Embryology and Anatomy, and the library of the French scientist, Lavoisier. The Department of Manuscripts and University Archives is a repository with total holdings of more than twenty-one million items. These manuscripts relate to all aspects of the economic, political, and social history of this region and the areas historically connected with it. In addition to the collections in Olin Library, many of the college and department libraries also contain materials unique in their fields. Curators and reference librarians are available for counsel concerning the availability and use of research materials.

In addition to Olin Library, the Cornell University library system comprises Uris Library, an open-stack library for undergraduates; the Albert R. Mann Library of Agriculture and Life Sciences and Human Ecology; and the libraries of the following colleges, schools, and departments: Fine Arts, Business and Public Administration, Engineering, Hotel Administration, Industrial and Labor Relations, Law, Medicine (in New York City), Veterinary Medicine, Entomology, Mathematics, Music, and Physical Sciences. Added to these are the libraries of academic divisions and departments, together with those of the Agricultural Experiment Station at Geneva, New York.

International Studies Programs

Cornell's approach to international studies is distinctive. There is no separate school or department of international studies with its own faculty and degree program. Rather, the variety of interests of the broad range of colleges and schools at Cornell and the diverse array of their departmental offerings form the foundation for strength in this area.

Students at Cornell have extensive opportunities to specialize in international studies at both the graduate and undergraduate levels. There are more than twenty formal programs of teaching and research on specific world regions or problem areas.

Undergraduate and graduate students may develop majors or minors in various aspects of international studies through the different colleges, schools, and departments in which they are enrolled and through participation in the various programs. Many students with majors in other disciplines take courses in aspects of international and comparative studies that relate to and complement their majors. In addition, faculty members frequently provide special opportunities for graduates and undergraduates to do work in particular facets of international studies.

Center for International Studies

The Center for International Studies supports and coordinates the University's programs of international and comparative studies. By serving as a focal point for ideas, information, and advice about the University's wide range of international offerings, the center contributes to their further development. The center places particular emphasis on strengthening inquiry into issues that cut across professional and area concerns and providing a continuing source of innovation and experimentation in international studies. Through its constituent programs it promotes interdisciplinary teaching and research to supplement work done within the regular departments and fields.

The center engages in a range of other activities. It sponsors the graduate degree program, Master of Professional Studies (International Development), which consists of eleven to eighteen months of interdisciplinary study for experienced practitioners in international development. The center supports undergraduate interdisciplinary course offerings that are designed to bring the insights of several disciplines to bear on major international problems. It frequently appoints visiting faculty and currently shares several permanent appointments with various departments. It sponsors lectures and seminars and brings distinguished visitors to Cornell to participate in conferences devoted to problems of international significance. The center provides information on legislation of concern to the international studies community at Cornell, and keeps abreast of the possibilities for financial support for international studies. It publishes an annual report of international studies at Cornell.

A program of grants (up to $750 for graduate students and faculty) for research of international or comparative significance, awarded competitively in the spring semester, is sponsored by the center.

Further information may be obtained from the Center for International Studies, 170 Uris Hall.

China-Japan Program

This program provides comprehensive graduate-level training and sponsors a wide range of research. Graduate students in the program take a major in anthropology, economics, government, history, history of art, linguistics, or literature. Early mastery of the Chinese and Japanese languages sufficient to permit use of Chinese and Japanese sources in courses and seminars and in research is expected. FLAS (formerly NDFL) Title VI fellowships are available to some students in the program.

The focus of much of the research and teaching in the program is the history, society, economy, and culture of traditional and contemporary China and Japan. Research supported by the China-Japan Program includes Chinese and Japanese economic development; center-regional relationships in traditional and modern China; Japanese and Chinese linguistics; Southern Chinese and Sino-Tibetan dialects; contemporary Chinese and Japanese international relations; classical and early modern Chinese and Japanese literature; the religions and societies of Japan and China; ancient and contemporary Chinese relations with Southeast Asia; and cultural-religious practices of the China/Southeast Asia border regions.

Additional information on the program and the various fellowships and awards may be obtained by writing to the Director, China-Japan Program, 140 Uris Hall.

International Agriculture Program

The International Agriculture Program provides opportunities for graduate-level study and research on agricultural and rural development in developing nations. A minor in the Field of International Agricultural and Rural Development is offered for the M.S. and Ph.D. degrees. Individuals with experience or those employed in developing countries who desire a broad nondiscipline-oriented graduate program may apply for the Master of Professional Studies (M.P.S.) degree in this field. Students may take courses that help them apply their knowledge to the special conditions of newly developing nations, consult with experienced faculty members in regard to such applications, and pursue dissertation research projects relevant to special problems of newly developing countries. There are opportunities to draw upon the strong international programs in various colleges of the University, including the area study programs and the offerings in modern languages.

Additional information may be obtained by writing to the Director, International Agriculture Program, 261 Roberts Hall.

International and Comparative Labor Relations

The graduate program in the School of Industrial and Labor Relations includes a major and minor subject in international and comparative labor relations. It is supported by the extensive holdings of foreign and international materials in the library of the School and by the research activities of faculty members working in this area. The basic courses cover the industrialized as well as less developed countries.

International Legal Studies Program

The International Legal Studies Program offers concentrated study in international legal subjects. The full program is ordinarily pursued by J.D. candidates in their second and third years of regular law study, but all the courses in the field are open to graduate students in law. Some of the courses are offered by visiting faculty members who come to the Law School under its program for distinguished foreign professors. A number of foreign scholars and students also come to Cornell for research and study in the comparative and international law fields. Other activities of the International Legal Studies Program have included faculty seminars and conferences on comparative and international legal topics, and a program of speakers and seminars open to students.

For more detailed information, see the *Announcement of the Law School* and the current annual report of the Center for International Studies, or write to Professor John J. Barceló III, Chairperson, Graduate Study Committee, Cornell Law School.

International Nutrition Program

This program provides graduate-level training for those concerned about nutrition problems in low-income countries. International nutrition is one of the five major areas available to students working towards a Ph.D. or M.S. in the Field of Nutrition. It is also one of the four concentrations available for the Master of Professional Studies (International Development) degree. A number of persons from fields such as Food Science or Agricultural Economics minor in international nutrition. Others spend time in the program as postdoctoral fellows, as special students or non-degree candidates, or as visiting fellows.

The International Nutrition Program caters both to foreign students who will be undertaking nutrition work in their own countries and to American students who are interested in careers in international nutrition. There is an increased recognition of world food and nutrition problems, in the complexity of their etiology, and in the multidisciplinary approach needed for their solution. The Cornell approach is perhaps unique in its attempt to address these issues in a program that includes broad training, research in several different parts of the world, and service to international agencies and to Third World countries.

Further information may be obtained from Professor Michael C. Latham, Director, International Nutrition Program, Division of Nutritional Sciences, 127 Savage Hall.

International Population Program

At the graduate level, this program stresses the relation of social and cultural factors affecting fertility, mortality, migration, and urbanization in various parts of the world. Teaching in the program also includes demographic techniques and theory, family planning, ecology, population policy, and health and medicine.

A Ph.D. candidate can major or minor in demography-ecology. An M.A. candidate in the program usually minors in demography-ecology and majors in general sociology. Admission as a Ph.D. major in demography-ecology or as an M.A. major in general sociology minoring in demography-ecology, is available to students in the graduate Field of Sociology. Students from most other graduate fields may elect a minor within the program. Population is one of the four concentrations available for the Master of Professional Studies (International Development) [M.P.S.(I.D.)] degree. Further information may be obtained from the International Population Program, Room 372, Uris Hall.

Latin American Studies Program

Resources in Latin American studies include formal course work, ample library facilities, and widely based research networks developed by the faculty. There is diversity, for some aspect of virtually every Latin American country has been examined by at least one member of the program. Research tends to be problem-oriented, with relevant data applied from various fields.

Building on more than twenty years' experience in the Andean region, program members are currently involved there in research which includes the disciplinary perspectives of sociology, anthropology, archaeology, economics, and linguistics.

Investigation of the unique experience of Brazil is currently being carried out by a number of researchers in sociology, economics, history, and agriculture.

In addition to these specific geographical concentrations, research is underway on problems generally characteristic of developing nations: the processes and consequences of rapid agricultural development, urbanization, population problems, science and technology policies, and the presence of the United States in Latin America.

Graduate students are encouraged to join with faculty members in their current projects and to contribute to the expansion of knowledge about Latin America through their own research efforts. Cornell students have been successful in obtaining funds for dissertation field research from sources such as the Social Science Research Council, the Fletcher School of Law and Diplomacy, Fulbright-Hays, the Doherty Foundation, the Inter-American Foundation, and the Organization of American States.

Additional information may be obtained by writing to Donald K. Freebairn, Director, Latin American Studies Program, 190 Uris Hall.

Peace Studies Program

The Peace Studies Program sponsors teaching and research on the moderation or avoidance of war, and on the political, economic, technical, and social implications of progress towards peace. In graduate teaching and research, the program emphasizes an interdisciplinary approach involving social scientists, natural scientists, engineers, and lawyers. Graduate students can participate by choosing one or more faculty members associated with the Peace Studies Program to serve on their Special Committees. Students are encouraged to participate in the colloquia, research, and publication activity sponsored by the program. Student fellowship and research resources are available.

Further information may be obtained from the Director, Professor Franklin A. Long, Center for International Studies, 170 Uris Hall.

Program on Participation and Labor-Managed Systems

In the world today, in different forms and in varying degrees, we witness a tendency for workers to assume control and management of the enterprises in which they are employed. The Yugoslav economy is the best known example but there are many other instances.

As a result, the Program on Participation and Labor-Managed Systems was established in 1970 to conduct theoretical and empirical research in the theory, practice, and implementation of self-management and to sponsor course offerings, workshops, and conferences. Two or three courses are offered each year in this area in the Department of Economics. In addition, there are guest lecturers and an occasional course in cooperation with other schools and departments.

Extensive cross-disciplinary cooperation has been developed with other schools and departments at Cornell, such as the College of Agriculture and Life Sciences, the Graduate School of Business and Public Administration, the School of Industrial and Labor Relations, and the departments of City and Regional Planning, Education, Government, and Rural Sociology. Faculty from most of these fields are represented on the Executive Committee of the program.

A documentation center to serve as a resource in the area of participation and labor-managed systems is being developed at Cornell under the auspices of the program.

The Department of Economics offers a Ph.D. major and a minor in the area of participation. The faculty taking part are Tom E. Davis, George J. Staller, and Jaroslav Vanek, who is also the director of the program.

The Program on Policies for Science and Technology in Developing Nations

The PPSTDN program sponsors multidisciplinary teaching and research related to the use of science and technology by developing countries in pursuit of their developmental goals. Emphasis is placed on how these countries can build indigenous capabilities to make informed choices among existing technologies, to adapt them to domestic conditions, and to foster innovation in order to become less dependent on external sources of technology. Research themes include agricultural production (particularly food processing), industrial production, regional development planning (particularly low-cost housing policy and transportation), engineering educational planning and programs for national development, and management of natural resources (particularly water). Issues that cut across these themes include rational development objectives, characteristics of alternative technologies,

sources of technology supply, nature of technology demand, linkages between supply and demand, and the institutional infrastructure for designing and implementing national science and technology policy.

Graduate students may include PPSTDN study or research in their programs in several ways. A graduate minor may be arranged through the interdisciplinary Field of Public Policy, which includes a science and technology policy "stream." Ph.D. candidates can focus their studies in this area by working with the PPSTDN program through members of their Special Committees who are program participants. A science and technology policy concentration is available in the Master of Professional Studies (International Development) program; this is intended for mid-career practitioners who wish to upgrade their skills in science and technology policy analysis and implementation. Graduate and faculty research is facilitated by a modest special library maintained by PPSTDN.

The initial development of the program was supported by a grant from the Agency for International Development. Current funding is sought through proposals for specific projects.

Further information may be obtained from the Program on Policies for Science and Technology in Developing Nations, Room 180, Uris Hall.

Rural Development

Although there is no formal major or minor in rural development, students can participate by selecting for their Special Committees faculty members interested in rural development. Interested students may choose to work on rural development issues by selecting the fields of Public Policy or International Agricultural and Rural Development as minors complementing their major fields. Students who wish to do professional studies on particular aspects of rural development can work for a Master of Professional Studies degree in Agriculture or in International Development. The Rural Development Committee brings together Cornell's strengths in this interdisciplinary area by supporting a program of research, publication, guest speakers, and scholars in residence. Further information may be obtained from Professor Norman Uphoff, Center for International Studies, 170 Uris Hall.

South Asia Program

The South Asia Program encompasses the study of Bangladesh, Bhutan, Sri Lanka (Ceylon), India, Nepal, and Pakistan. Qualified graduate students interested in specializing in the study of South Asia can minor in the Field of Asian Studies, in South Asian linguistics, or in Oriental art (South Asian art history). The doctoral candidate should achieve a reading knowledge of Hindi or some other important language of South Asia. Doctoral dissertations of students in the South Asia Program are normally based on research done in one of the countries of the area. At least one member of the South Asia Program faculty has been in South Asia for each of the past several years. Cornell is a charter member of the American Institute of Indian Studies, organized to facilitate study and research in India, and maintains close links with a number of South Asian research agencies, programs, and institutions of higher learning whose staff members have provided valuable assistance to Cornell students. Graduate students may become associated with Cornell-sponsored research in South Asia or carry on independent research abroad.

Current research studies include a long-term research project primarily concerned with agricultural development and its ramifications in India; research projects on the palaeoanthropology of the subcontinent of India and Sri Lanka, and religion and cultural change. Other studies include rural development and communications. Several studies are being conducted on languages of the area, including a special study of the Sinhala language and linguistics problems of Sri Lanka, and research in Hindi, Tamil, and Telugu (important languages of India). With Ford Foundation support, Cornell has assisted Delhi University to become a major center in the field of linguistics and has an ongoing interest in such applied projects.

National Defense Education Act Title VI (FLAS—formerly NDFL) Fellowships are open to incoming graduate students. Since all degrees are given with majors in disciplinary fields rather than in regional studies, students should apply directly to the graduate field of their interest.

Additional information about the South Asia Program may be obtained by writing to the Director, South Asia Program, 130A Uris Hall.

Southeast Asia Program

The Southeast Asia Program offers substantial facilities for graduate study and research and provides exceptional opportunities for the study of all of Southeast Asia in various disciplines of the humanities, social sciences, and some natural sciences. Apart from the specialized major fields of Southeast Asian history and Southeast Asian art history, there is no major field in Southeast Asian studies as such, and graduate students may major in a discipline and minor in Asian Studies/Southeast Asia, Southeast Asian linguistics, Southeast Asian history, or Southeast Asian art history. Instruction in the major languages of the region is an integral part of the graduate training of the program, which is also strengthened by exceptional library resources, regular interdisciplinary courses on the countries of the region, and an extensive program of informal seminars and visiting lecturers.

Possible sources of financial aid include Southeast Asia Program Fellowships; National Defense Education Act Title VI (FLAS—formerly NDFL) Fellowships; and, for advanced Ph.D. candidates, Fulbright-Hays funded Doctoral Dissertation Research Fellowships, and International Dissertation Research Fellowships administered by the Social Science Research Council.

Additional information on the program and the various fellowships and awards may be obtained by writing to the Director, Southeast Asia Program, 120 Uris Hall.

Soviet Studies

The University offers many courses and seminars on the Soviet Union as well as pre-1917 Russia. Instead of a separate area program, graduate students have a

choice of majors and minors in the established fields of the Graduate School. Some of the subjects focus on area specializations: Russian history, Russian literature, Slavic linguistics. Other subjects combine area specialization within a wider framework: comparative government, economic planning, regional planning, social psychology. Graduate students pursuing Soviet studies in any of these subjects are expected to attain proficiency in the Russian language either before or soon after entering the Graduate School.

The Committee on Soviet Studies coordinates the University's academic activities related to Russia and sponsors a colloquium for faculty members and graduate students in Soviet studies. In the Soviet Studies Graduate Study in the John M. Olin Library, major reference works and key current periodicals from and about the U.S.S.R. are brought together. Inquiries about fellowships and other aspects of Soviet studies should be addressed to Professor George Staller, Chairperson, Committee on Soviet Studies, Uris Hall.

Western Societies Program

The Western Societies Program, with Europe as its substantive core but with interests in other advanced societies, gives primary emphasis to historical and contemporary developmental problems of the West. Among the program's concerns are comparative public policy issues; the problem of cultural identities and center-periphery tensions in modern Europe; the changing social cleavages and patterns of conflict between labor and management in advanced societies; the crises of economic and policy planning in the face of recent changes in social and political participation; and the problem of the control and use of technological resources in the contemporary Western economy. The program's members are also interested in the impact on Western societies of the growing interdependence of the international system: economic, political, and strategic.

The Western Societies Program includes faculty from the social sciences, history, industrial relations, public policy, and urban and regional planning, and is administered by an executive committee drawn from these departments. The program provides moderate research support for students and faculty, organizes workshops and conferences, and sponsors visiting scholars. Students can participate in regularly scheduled seminars on the problems of Western societies and use the resources of the program for fellowship inquiries and for assistance in making contacts for research abroad. Fellowships and research assistantships are available, mainly to advanced graduate students.

Additional information may be obtained from Professor Douglas Ashford, Director, Western Societies Program, 170 Uris Hall.

Other Programs and Resources

The Africana Studies and Research Center

The Africana Center was created in an effort to remedy the deficiencies in the higher education of blacks. The basic concept of the center is recognition of the responsibility of the black educator not only to pioneer and develop black studies as a vital educational field, but also to train people who will be intellectually and technically competent.

The graduate program is designed to afford as much opportunity as possible for structuring curricula suited to the student's individual aspirations. To facilitate these plans, the center is developing an Africana library with extensive coverage.

Additional information may be obtained from the Africana Studies and Research Center, 310 Triphammer Road, Ithaca, New York 14853.

American Studies

Although there is no formal program leading to a degree in American studies, candidates for the doctorate in English and history will find ample opportunity to do interdisciplinary work in conjunction with a major in American studies within their field. There are members of the staff in both fields who are professionally trained and currently active in the study of the interrelationships of American intellectual, literary, and social history, so that a student concentrating in American literature or American history may take advantage of the freedom permitted by Graduate School regulations and, in collaboration with his or her Special Committee, readily build an individual doctoral program that systematically embraces more than a single discipline. Inquiries concerning opportunities in this area should be addressed to American Studies Committee, Professor Robert H. Elias, Department of English, Goldwin Smith Hall; or to Professor Richard Polenberg, Department of History, McGraw Hall.

The Division of Biological Sciences

Established in 1964 to bring together into a single administrative unit a number of investigators and teachers representing a broad spectrum of interests in basic biology, the division has the primary responsibility for the promotion of research in basic biology, and its members, as part of the Graduate School faculty, teach in appropriate fields. The subject areas of biochemistry, ecology and evolutionary biology, genetics, botany, zoology, and neurobiology and behavior are represented by separate sections of the division: biochemistry, molecular and cell biology; ecology and systematics; genetics, development and physiology; animal physiology; and neurobiology and behavior. A number of fellowships, assistantships, and traineeships are available through the division.

Further information may be obtained by writing to the appropriate faculty representative.

Biophysics Program

Biophysics appears in many departments and graduate fields at Cornell. There is no single department or field of biophysics, but rather biophysics research and study at the graduate level are carried on as a part of the programs of various fields including Applied Mathematics, Applied Physics, Biochemistry, Botany, Chemical Engineering, Chemistry, Electrical Engineering, Materials Science and Engineering, Mechanical Engineering, Neurobiology and Behavior, Physics,

Physiology, and Theoretical and Applied Mechanics. Biophysics programs are loosely coordinated by a Biophysics Advisory Committee, which sponsors various joint activities of the various fields.

The diversity of biophysical interests and affiliations among the faculty makes biophysics accessible through many fields, particularly since choice of the thesis research subject and supervisor may transcend field membership. The special committee system of supervision of graduate study is particularly amenable to an interdisciplinary area such as biophysics, but because there is such diversity, prospective students should choose carefully the field to which to apply, according to interests and background preparation.

Students in biophysics are required to have a sound grasp of both the "bio" and the "physics" aspects of the area. They will therefore be encouraged to aim for considerable breadth in their graduate training, as well as specialization in one particular branch. Students in biophysics may be advised by their Special Committees to take a large number of formal courses to achieve this breadth and consequently it may take a year or so longer than normal to obtain a Ph.D.

A fellowship program supports graduate study in biophysics. Three Biophysics Graduate Fellowships with stipends identical to the Cornell Graduate Fellowships are available for the 1978-79 academic year. Candidates are nominated by the faculty representatives of the graduate fields and students should indicate their interest in the Biophysics Fellowships to their graduate faculty representative.

The courses that include biophysics appear in the offerings of various departments. A brochure with available courses and program descriptions can be obtained from the Biophysics Advisory Committee, School of Applied and Engineering Physics, Cornell University, Clark Hall, Ithaca, New York 14853.

Faculty involved in research with a biophysical orientation are included in the following listing:

D. L. Bartel (mechanical engineering): biomechanics; analysis and design of orthopedic implants, modeling of the musculo-skeletal system

H. D. Block (applied mathematics, theoretical and applied mechanics): artificial intelligence, brain models, cybernetics, self-learning

R. R. Capranica (electrical engineering, neurobiology and behavior): neural mechanisms underlying sound communication; mechanism of frequency analysis in the inner ear

R. K. Clayton (applied physics, botany): mechanism of photosynthesis

S. J. Edelstein (biochemistry): cooperative interactions and assembly of supramolecular structures; analytical ultracentrifugation; electron microscopy and image reconstruction

E. L. Elson (chemistry): conformational transformations in nucleic acids and proteins; mobility on cell membranes

G. W. Feigenson (biochemistry): protein-lipid interaction in membrane systems; NMR spectroscopy

D. B. Fitchen (physics): laser Raman studies of heme protein conformation

Q. H. Gibson (biochemistry): mechanism of action of hemoglobin; stopped-flow reaction kinetics

B. P. Halpern (neurobiology and behavior): neurophysiology of sensory systems

G. G. Hammes (biochemistry, chemistry): mechanisms of enzyme regulation and catalysis; thermodynamic, kinetic, and structural studies; rapid reaction kinetics; nano-second fluorimetry

W. J. Heetderks (electrical engineering): multiple unit neural studies

G. P. Hess (biochemistry): chemical reactions in the transmission of nerve impulses; enzyme kinetics

P. C. Hinkle (biochemistry): membrane transport and chemiosmotic coupling; measurement of pH gradients

H. C. Howland (neurobiology and behavior): mechanics of vertebrate semicircular canal; physiological optics

J. Jenkins (applied mathematics, theoretical and applied mechanics): biomechanics; modeling of red blood cells; continuum mechanics of soft tissue

H. H. Johnson (materials science and engineering): collagen as a biomaterial

M. Kim (electrical engineering): membrane properties of pacemaker neurons; visual nervous system; cancer cell kinetics

R. L. Levin (mechanical engineering): cryobiology

S. A. Levin (applied mathematics, ecology and evolutionary biology): mathematical biology; ecology and population dynamics; mathematical ecology

A. Lewis (applied physics): laser probes of the molecular basis of vision and light energy conversion

R. E. McCarty (biochemistry): structure and function of chloroplast membranes; measurement of pH gradients

J. K. Moffat (applied physics, biochemistry): structure and function of hemoglobin and calcium binding protein; x-ray crystallography

F. Moon (theoretical and applied mechanics): bone mechanics

R. D. O'Brien (neurobiology and behavior): molecular biology of excitable cells

T. R. Podleski (neurobiology and behavior): differentiation of muscle cells in culture

E. Racker (biochemistry): membrane structure, function, and reconstitution; bioenergetics

R. H. Rand (applied mathematics, theoretical and applied mechanics): biomechanics; modeling of leaf stomata; mechanics of transpiration in plants

S. A. Rubinow (applied mathematics): biological fluid dynamics, enzyme kinetics, cell growth

M. M. Salpeter (applied physics, neurobiology and behavior): electron microscopic investigations of neural function; quantitative electron microscope autoradiography of trophic and excitable tissue

H. A. Scheraga (chemistry): protein structure and function

B. M. Siegel (applied physics): high resolution electron microscopy of biological structures

R. M. Spanswick (applied physics, botany): biophysical studies of ion transport in plants

J. Stevenson (chemical engineering): permeability measurements for hollow fiber membranes

D. N. Tapper (neurobiology and behavior, physiology): neural basis of skin sensibility

D. A. Usher (chemistry): nucleic acids; prebiotic evolution, sequence-specific modification, hydrolysis

R. H. Wasserman (physiology): membrane transport; transport of mineral ions across epithelial membranes

W. W. Webb (applied physics, physics): membrane and enzyme dynamics of biological cell processes; fluorescence correlation spectroscopy; diffusion on cell membranes

Brookhaven National Laboratory and Fermi National Accelerator Laboratory

Cornell is one of nine eastern universities participating in Associated Universities, Inc. (AUI). Operating under contract with the Atomic Energy Commission, this corporation has the responsibility for the management of Brookhaven National Laboratory. The Laboratory provides unusual research facilities for studies in biology, chemistry, applied mathematics, medicine, physics, high-energy particle physics, and reactor and nuclear engineering.

Cornell is also a member of Universities Research Association, Inc., which operates the Fermi National Accelerator Laboratory at Batavia, Illinois, where a 500-GeV proton synchrotron is in operation. Several groups of Cornell physics staff are participating in work on this new frontier of elementary-particle-physics.

Graduate students may participate in research at the Brookhaven or Fermi Laboratory by association with Cornell staff members who are engaged in research at these laboratories. Both laboratories also offer temporary summer appointments to a limited number of selected graduate and undergraduate students in science or engineering.

Office of Computer Services

The principal computing facility at Cornell is an IBM 370 Model 168 computer located at Langmuir Laboratory in Cornell's Research Park. The 370/168 is equipped for remote job entry from campus locations and for interactive time-sharing communication from remote terminals. Graduate students are encouraged to use the 370/168.

The high-speed remote job entry reader-printers are located at Uris, Warren, Baker, and Upson Halls. Job turnaround is usually very fast but depends on the priority of each submitted job. Each facility has consulting assistance, reference materials, and work space for students. A courier service for printed output connects these facilities with Langmuir and with each other.

In addition, the Uris facility has public time-sharing terminals which can be used to access the computer's interactive systems. Consulting and programming assistance for interactive systems is available. Terminals are also available for individual projects that require interactive capacity.

OCS operates on a full charge-back basis, but funds are usually available within each department to pay computing costs of unsponsored research and instructional computing. In addition, batch jobs of a reasonably small size can be run without charge under the instant turnaround facility.

For further information about the operation of the system and the availability of specific compilers, interactive systems, and consulting and programming assistance, write to the Office of Computer Services, User Services Office, G-26 Uris Hall.

Center for Environmental Research

The Center for Environmental Research is an interdisciplinary organization serving the entire University at the graduate study and research level, intended to promote and coordinate a comprehensive program in the planning, development, management and use of water, land, and air resources. Its responsibilities are to undertake and support water resources and other environmental research in engineering, in the physical, biological, and social sciences, and in the humanities; to encourage and contribute to graduate studies in environmental resources and their control; to coordinate relevant research and training activities; to encourage new combinations of disciplines in research and training that can be brought to bear on environmental problems; to disseminate the results of research; to collect and maintain a central source of information on environmental issues; and to seek external funding that will enable it to better meet its responsibilities.

Correspondence concerning the center should be directed to Professor Gilbert Levine, Director, Center for Environmental Research, Hollister Hall.

Materials Science Center

The Materials Science Center (MSC) is an interdisciplinary laboratory created to promote research and graduate student training in all phases of the science of materials. The subjects of study represented in the MSC program are applied physics, chemistry, electrical engineering, materials engineering, materials science, mechanics, metallurgy, and physics.

For a student who chooses to specialize in one of the areas represented in the MSC program, the center can help by providing funds for new equipment, laboratory supplies, and research assistantship support. In addition, the 15 central technical facilities operated by the center are available to provide access to sophisticated major equipment such as electron microscopes, crystal growing furnaces, X-ray and metallurgy apparatus, etc. The technical staff in each facility gives advice on use of the equipment, assists with routine measurements, and is continually developing the technology of its particular area.

Further information may be obtained from the Director, 627 Clark Hall.

New York State Agricultural Experiment Station at Geneva

The experimental station, established in 1880, is located at Geneva, fifty miles from Ithaca, and has been under the administration of Cornell University since 1923.

Professors on the Geneva staff are eligible to serve along with professors on the Ithaca campus as members of the Special Committees of graduate students. Normally, the graduate training provided at Geneva consists of research experience and supervision of the student's work on a thesis problem in chemistry,

economic entomology, food technology, microbiology, plant pathology, pomology, seed investigations, and vegetable crops. Students who plan to do part of their graduate work at Geneva should correspond with their major advisers or with the dean of the Graduate School concerning pertinent regulations. Ample facilities are available for graduate research under laboratory, greenhouse, pilot-plant, insectary, orchard, and other field conditions.

Further information may be obtained by writing the director, Professor D. W. Barton, New York State Agricultural Experiment Station, Geneva, New York 14456.

Division of Nutritional Sciences

The Division of Nutritional Sciences is an academic unit on the Cornell campus with responsibilities for various aspects of human nutrition. Both master's and doctoral degrees and the professional degree, Master of Nutritional Sciences, are awarded through the Field of Nutrition. The presence of professors from many disciplines provides Cornell with a strong but diversified sphere of nutritional science. These interests include human and international nutrition, nutritional biochemistry, public health, general nutrition, dietetics, nutrition and behavior, nutrition and health education, and community nutrition. A number of assistantships are available through the division. Further information may be obtained by writing to M. C. Nesheim, Director, Division of Nutritional Sciences, Savage Hall or to E. Elizabeth Hester, Graduate Faculty Representative in Nutrition, Martha Van Rensselaer Hall.

Officer Education (ROTC)

As a land-grant institution chartered under the Morrill Act of 1862, Cornell has offered instruction in military science for more than one hundred years. Cornell provides this instruction through the Reserve Officers Training Corps programs of the three military departments: the Army, the Navy, and the Air Force. The ROTC programs offer graduate students the opportunity to earn a commission while completing their advanced degree. To obtain a commission in one of the armed services, students must complete a two-year course of study in an ROTC program and must meet certain physical standards. Upon completion of requirements, students receive a commission and serve a tour of active duty in the United States Army, Navy or Air Force.

Further information is provided in the *Announcement of Officer Education,* which may be obtained by writing to Cornell University Announcements, Building 7, Research Park, Ithaca, New York 14853. Interested individuals are also directed to the appropriate ROTC office in Barton Hall.

Laboratory of Plasma Studies

The Laboratory of Plasma Studies at Cornell, established in 1966, enables students and faculty members to investigate plasma, electron, and laser physics on a unique, interdisciplinary basis. Plasma physics plays a key role in the worldwide effort to achieve controlled thermonuclear fusion, which promises a practically limitless supply of energy. It is also of fundamental importance in our understanding of astrophysics and space physics. The unified approach to plasma studies enables the University to give the best counsel to graduate students who want to combine their knowledge of some field of science or engineering with work in plasma studies. A program now exists whereby graduate study in plasma physics is offered to students in aerospace and mechanical engineering, applied physics, astronomy, chemistry, electrical engineering, and physics. Graduate research assistantships and positions as postdoctoral research associates are available through the laboratory.

Further information may be obtained by writing to Director, Laboratory for Plasma Studies, Upson Hall.

Center for Radiophysics and Space Research

This center unites research and graduate education carried on by several academic departments in the space sciences. It furnishes administrative support and provides facilities for faculty members and graduate assistants who are engaged in space research activities. It offers opportunity for graduate students to undertake thesis work in astronomy and astrophysics, atmospheric and ionospheric radio investigations, radar and radio astronomy, lunar and planetary studies, or space vehicle instrumentation. A student's major professor can be chosen from the following fields in the Graduate School: Aerospace Engineering, Applied Physics, Astronomy and Space Sciences, Chemistry, Electrical Engineering, Physics.

The facilities of the center include, on the Cornell campus, the Lunar Surface Laboratory, the Infrared Laboratory, and the Laboratory for Planetary Studies; close to Ithaca are the Radio Astronomy and Ionospheric Laboratories. Students may also be associated with the Cornell-operated National Astronomy and Ionosphere Center (NAIC) which operates the world's largest radar-radio telescope at Arecibo, Puerto Rico. At Arecibo an extremely sensitive radio telescope and unusually powerful space radar are available for use by qualified graduate students who often conduct their thesis research while resident there.

Program on Science, Technology, and Society

Raymond Bowers, director; Stuart M. Brown, Jr., associate director

The Program on Science, Technology, and Society (STS) was established in 1969 to stimulate and initiate teaching, research, and dissemination of information on the interactions of science and technology with society. The program is interdisciplinary and campuswide, drawing its students, faculty, and researchers from a wide range of academic fields.

Topics of concern to the program include science and technology policy, biomedical ethics, technology assessment, citizen participation in technological decision making, environmental law and ethics, arms control and national defense policy, humanistic implications of science and technology, and the sociology of science. These and other subjects are studied through courses, graduate and faculty seminars, workshops, conferences, and research projects.

In cooperation with University academic departments and centers, the STS Program has participated in the development of over two dozen interdisciplinary courses at both the graduate and undergraduate levels. Courses developed by the program are designed to both synthesize and contrast the perspectives of several academic disciplines in the analysis of relationships among science, technology, and the needs, values, and institutions of modern societies. STS-sponsored courses are open to all University students who meet course prerequisites. The program takes part in the undergraduate Biology and Society major, established in 1976 within the College of Arts and Sciences, and in the graduate Field of Public Policy, offering a science policy "stream" within this minor field. Limited funding may be provided for interdisciplinary thesis research on STS-related subjects, and appropriate requests for support will be considered.

The program annually publishes a booklet describing its courses and curricula. Information on STS research and publications may be obtained by contacting the Program on Science, Technology, and Society, 628 Clark Hall, Cornell University, Ithaca, New York 14853.

Society for the Humanities

The Society for the Humanities awards three categories of fellowships for research in the humanities—Senior Fellowships, Faculty Fellowships, and Junior Postdoctoral Fellowships. The fellows offer informal seminars intended to be off the beaten track. Details about the seminars are circulated to interested departments and are listed in the *Cornell University: Description of Courses* announcement.

Membership in the society's seminars is open, upon special application, to graduate students and suitably qualified undergraduates. The student's college determines if a seminar may be taken for credit. There are no examinations, and it is at the discretion of the fellow whether to require only oral reports or a research paper as well. All seminars are held in the society's quarters, Andrew D. White House, 27 East Avenue.

Persons other than those officially enrolled may attend as visitors with the permission of the instructor.

The fellows for 1977-78 were: Martin Bernal (Cornell University); Alberto Escobar (Instituto de Estudios Peruanos); Nelly Furman (Cornell University); Kennell Jackson, Jr. (Stanford University); Barbara Malament (Queens College); René Wellek (Yale University).

Statistics Center

The methods of statistics find important applications in many diverse fields of research. It is therefore necessary that (1) subject-matter specialists be able to obtain assistance in using or developing statistical theory; (2) students who intend to do research work in a particular field that makes extensive use of statistical methods receive adequate training in statistics; and (3) individuals be trained as statisticians. The staff members of the various schools and colleges of Cornell University who are interested in the development and application of statistical methods are associated with the Cornell Statistics Center, which provides individuals, projects, and departments with assistance and guidance concerning the statistical aspects of research and training programs.

The director of the Statistics Center is Professor Ivor Francis, 359 Ives Hall.

Program in Urban and Regional Studies

The purpose of this program is to stimulate, develop, and support multidisciplinary research, teaching, and community service programs in urban and regional studies. It embraces the resources of the entire University, and faculty and graduate students from all relevant departments and colleges participate in its activities.

Principle emphasis is on the stimulation and facilitation of externally sponsored research of a policy and an applied nature, with special interest in projects that benefit from participation of persons from several disciplines. Small grants are made from program development funds to assist faculty in early stages of research development. Community service and extension programs are aimed chiefly at local government and at regional and health planning agencies. The program also sponsors and supports conferences, symposia, seminars, and summer short-courses and it actively encourages interdepartmental courses.

The program's range of interests includes regional science, urban gaming and large-scale simulation, local government operations and financial management, local government collective bargaining, health planning and delivery systems, urban transportation, national growth policy, disaster planning and amelioration, public housing policy and evaluation, site development, mobile home site planning, residential livability, tenant education, housing manager training, historic preservation, architecture and landscape architecture, land-use policy, and urban technology.

The graduate Field of Regional Science and the Field of Urban Studies, administered through the program, provide a continuing forum for scholarly inquiry and study. The magnitude of course offerings and the flexibility of graduate requirements allow a large measure of latitude in selecting courses of study from the regular offerings of various departments of the University. Opportunities to participate in research activities of the program are available to a selected number of graduate students.

Further information may be obtained from the Program in Urban and Regional Studies, 726 University Avenue, Ithaca, New York 14853.

Cornell University

Fields of Instruction

Aerospace Engineering

Graduate Faculty Representative: P. C. T. de Boer, 287 Grumman Hall.

Major Subject: Aerospace Engineering

Minor Subjects: Aerospace Engineering, Aerodynamics

Applicants should hold a bachelor's degree in engineering or the physical sciences. It is not recommended that candidates apply for admission at midyear, except in unusual cases.

Candidates must learn French, German, Russian, or English in addition to their native language to satisfy the language requirement for the Ph.D. degree.

Candidates who do not already hold a master's degree are encouraged to matriculate first as candidates for the professional degree, Master of Engineering (Aerospace). (See *Graduate Study in Engineering and Applied Sciences at Cornell.*) No final comprehensive examination is required for this degree.

In the Field of Aerospace Engineering, emphasis is placed on basic aerospace sciences to prepare students to cope with the characteristic diversity in research frontiers and industrial development. The faculty is particularly strong and active in fluid mechanics in its broadest definition. Current research includes various fundamental studies in fluid dynamics and aerodynamics such as turbulence, noise generation, transonic flows, unsteady flows, non-Newtonian fluid mechanics, and numerical methods. There is also a program in combustion engine processes, plus research in chemical kinetics, plasma dynamics, and structural mechanics.

Faculty and Specializations

P. C. T. de Boer, E. L. Resler, Jr.: combustion engine processes; kinetics of pollution; shock tube chemistry
P. L. Auer, P. C. T. de Boer, E. L. Resler, Jr.: plasma physics; collisionless shock waves
G. S. S. Ludford: mathematical theory of fluid dynamics, magnetohydrodynamics, and combustion phenomena
D. A. Caughey, A. R. George, S. F. Shen: fluid mechanics; aerodynamics including transonic and unsteady flows
A. R. George: noise generation by aerodynamic sources
R. H. Gallagher: structures and materials
D. L. Turcotte: geological fluid flows; geothermal flows
E. L. Resler, Jr.: ferrohydrodynamics
R. H. Gallagher, S. F. Shen: finite-element methods
J. L. Lumley, Z. Warhaft: turbulence; meteorological fluid dynamics
P. L. Auer: energy studies; systems analyses
D. A. Caughey: computational aerodynamics
S. F. Shen: rarefied gasdynamics; random processes

African and Afro-American Studies

Graduate Faculty Representative: J. Congress Mbata, Africana Studies and Research Center

Major and Minor Subject: Africana Studies

The field offers a program leading to the degree of Master of Professional Studies (African, Afro-American) [M.P.S. (A.A.A.)]. It is intended primarily for students interested in specializing in scholarly work—teaching, research, or creative arts—in some facet of the rapidly developing academic area of black studies.

The area of African and Afro-American studies has been established and defined under the Africana Studies and Research Center, and students participate significantly in its direction and development. Planned areas of research include many previously ignored facets of black existence as well as the contemporary political, economic, and social policies that shape the life of the black community. The Africana Center also wishes to encourage creative artists searching for a black aesthetic and to help develop new materials, approaches, and personnel for teaching black studies and black children.

Faculty

R. Bell, J. C. Mbata, R. Murapa, J. Turner

Agricultural Economics

Graduate Faculty Representative: K. L. Robinson, 40 Warren Hall

Major and Minor Subjects: Agricultural Economics, Applied Econometrics and Quantitative Analysis, Farm Management and Production Economics, International Economics and Development, Marketing and Food Distribution, Public Policy Analysis, Resource Economics

The field offers graduate training leading to the Master of Professional Studies (Agriculture), Master of Science, and Doctor of Philosophy degrees. Emphasis is placed on Ph.D. programs, though students normally are expected to obtain a master's degree first. Direct admission to a Ph.D. program may be considered if the applicant's preparation for graduate work is superior.

The Graduate School requirements for the M.S. and Ph.D. degrees (described in another section of this *Announcement)* provide for substantial flexibility in designing a student's program. The field requires that the Ph.D. student take one of the minors in another field (e.g., Economics). A thesis is required both for the M.S. and Ph.D. degrees. The M.P.S.(Agr.) program leads to a terminal degree for those wishing to study a subject pertinent to their profession.

All M.S. and Ph.D. applicants are urged to take the Graduate Record Examinations Aptitude Test; those seeking fellowships must do so. An undergraduate major in agricultural economics is not required for admission, but overcoming deficiencies in undergraduate training lengthens the graduate program.

The course work and thesis research opportunities in the Field of Agricultural Economics cover a broad range of topics. These include resource economics, community and regional development, public administration and finance, food economics, international trade, farm management and production economics, farm finance, price analysis, agricultural policy, and marketing. Necessary foundation courses in economic theory and quantitative methods are taught in other departments. To understand the breadth of economics at Cornell, the student should review course offerings in the Graduate School of Business and Public Administration, Department of Consumer Economics and Housing, Department of Economics, School of Industrial and Labor Relations, and Department of City and Regional Planning.

Assistantships in the Department of Agricultural Economics provide an opportunity for part-time employment in teaching, research, or extension. Thesis research is often conducted as a part of assistantship duties. Assistantship awards are made by the department chairperson on the basis of recommendations of the admissions committee. Applicants need only indicate on the admission form whether they wish to be considered for an assistantship.

Faculty and Specializations

Applied econometrics and quantitative analysis: R. N. Boisvert, R. B. How, R. A. Milligan, T. D. Mount, W. G. Tomek

Farm management and production economics: C. A. Bratton, J. B. Bugliari, G. L. Casler, H. E. Conklin, C. J. Conneman, Jr., W. A. Knoblauch, E. L. LaDue, R. A. Milligan, R. S. Smith, B. F. Stanton

International economics and development: R. Barker, S. L. Barraclough, D. Blandford, D. K. Freebairn, J. F. Metz, T. T. Poleman, D. G. Sisler, E. Thorbecke

Marketing and food distribution: R. D. Aplin, M. E. Brunk, W. K. Bryant, W. G. Earle, O. D. Forker, D. C. Goodrich, Jr., R. B. How, R. P. Story

Public policy analysis: R. N. Boisvert, D. U. Fisher, O. D. Forker, R. J. Kalter, B. Mason, K. L. Robinson, D. G. Sisler, W. G. Tomek

Resource economics: D. J. Allee, N. L. Bills, R. N. Boisvert, L. D. Chapman, R. J. Kalter

Agricultural Engineering

Graduate Faculty Representative: G. E. Rehkugler, 228 Riley-Robb Hall

Major and Minor Subjects: Agricultural Engineering, Agricultural Structures, Agricultural Waste Management, Electric Power and Processing, Power and Machinery, Soil and Water Engineering.

An applicant to the Ph.D. or the M.S. program must have a baccalaureate degree in an area of engineering, physical science, or biological science. Applicants for the Master of Engineering program must have a baccalaureate in engineering or its equivalent. Deficiencies in undergraduate training must be satisfied early in the advanced degree program. Applicants are strongly urged to submit scores of the Graduate Record Examinations Aptitude and Advanced Engineering Tests.

Ph.D. candidates are required to select at least one minor subject from outside the field. M.S. candidates are required to take agricultural engineering as their major subject and to select one minor outside the field. The M.S. and Ph.D. research degrees require the submission of an acceptable thesis.

The professional degree of Master of Engineering (Agricultural) is intended primarily for students who plan to enter engineering practice. This program is intended to develop students' backgrounds in engineering design as well as strengthen their fundamental engineering base. For further information, see *Graduate Study in Engineering and Applied Sciences at Cornell.*

The professional degree of Master of Professional Studies (Agriculture) with a concentration in agricultural engineering is intended for those who wish to further their training for practitioner-type work in agricultural technology, and who do not intend to become involved in engineering design and research. Each M.P.S.(Agr.) degree applicant must submit scores of either the Graduate Record Examinations or the Miller Analogies Test. A preliminary curriculum proposal must accompany an application for the M.P.S.(Agr.) degree program.

Faculty and Specializations

For information about current research projects, a prospective student should write to the graduate faculty representative.

Agricultural Engineering

All graduate faculty members: bioengineering, engineering properties of biological materials;

materials handling; and other subject areas listed below.

E. W. Foss, F. G. Lechner: agricultural mechanization and mechanization teaching; safety engineering

J. R. Cooke, R. B. Furry, D. A. Haith, R. H. Rand, G. E. Rehkugler, N. R. Scott, C. A. Shoemaker: biological engineering and mathematical modeling

E. W. Foss, L. H. Irwin, M. F. Walter: community and resource development

G. E. Rehkugler: food engineering

L. D. Albright, R. B. Furry: livestock engineering

Agricultural Structures

L. D. Albright, R. B. Furry, R. T. Lorenzen, D. R. Price, N. R. Scott: structural analysis and design; production systems analysis; design and synthesis; structural-biological relationships; environmental composition and control; biological response to environment; thermodynamic and heat transfer processes; livestock engineering

Agricultural Waste Management

D. A. Haith, W. J. Jewell, R. C. Loehr, D. C. Ludington, C. A. Shoemaker: agroecosystems analysis; pest management systems; animal and food processing waste management; identification and control of air and water pollution from agricultural activities; land disposal of wastes; rural environmental engineering; energy generation from agricultural residues

Electrical Power and Processing

R. B. Furry, R. W. Guest, W. W. Gunkel, D. R. Price, G. E. Rehkugler, N. R. Scott, E. S. Shepardson: electrical and electronic control systems; processing of agricultural materials; application of electromagnetic radiation to agriculture; systems modeling and analysis; efficient energy utilization and alternative energy sources; electronic instrumentation

Power and Machinery

J. R. Cooke, R. W. Guest, W. W. Gunkel, D. C. Ludington, E. D. Markwardt, W. F. Millier, R. H. Rand, G. E. Rehkugler, E. S. Shepardson: agricultural machinery design and development; crop harvesting, handling, and processing systems; machinery management; safety and human factors; biomechanics; physical and biological factors pertaining to machine design, such as soil mechanics in relation to seedling development and crop establishment

Soil and Water Engineering

R. D. Black, W. H. Brutsaert, L. H. Irwin, G. Levine, E. D. Markwardt, M. F. Walter: surface water hydrology, drainage; irrigation; soil-plant-water relationships; hydraulics; erosion control; tropical water management; water resource management; flood control; land use; soil stabilization; secondary road systems

Agronomy

Graduate Faculty Representative: Ralph L. Obendorf, 619 Bradfield Hall

Major and Minor Subjects: Atmospheric Sciences, Field Crop Science, Seed Technology (major only for M.S.), Soil Science

English-speaking applicants should submit the results of the Graduate Record Examinations.

Ordinarily students first complete a master's program, but direct admission to a doctoral program is permitted for exceptionally well-prepared students.

Since 1968, the field has occupied one of the most modern and diversified agronomic research facilities in the world. An air-conditioned, eleven-story research tower and adjoining wings incorporate fully equipped laboratory, teaching, office, and supporting spaces. Graduate students also have access to newly constructed growth chambers and greenhouse facilities on the campus and to three main field stations near Ithaca. Seed technology studies are conducted also in new quarters at Geneva; students may arrange to work there while enrolled at Ithaca. Some members of the field are staff members at the U.S. Plant, Soil, and Nutrition Laboratory (USDA) on the campus. A limited number of students can do most or all of their research overseas.

Faculty and Specializations

Soil chemistry: J. M. Duxbury, D. L. Grunes, M. B. McBride

Soil physics: E. R. Lemon, R. D. Miller

Soil microbiology: M. Alexander

Soil fertility: D. R. Bouldin, D. L. Grunes, D. J. Lathwell, W. S. Reid, T. W. Scott, M. T. Vittum

Soil morphology, genesis, and cartography: R. W. Arnold, J. Kubota, G. W. Olson, A. Van Wambeke

Soil and water conservation: F. N. Swader

Forest soils: E. L. Stone

Tropical soils: A. Van Wambeke

Organic soils: J. M. Duxbury

Soil and plant studies in aquatic environments: D. R. Bouldin, D. J. Lathwell, J. H. Peverly

Plant mineral nutrition: D. L. Grunes, R. M. Welch

Crop chemistry: W. B. Duke, D. L. Linscott, R. L. Obendorf

Crop physiology: W. B. Duke, G. W. Fick, R. B. Musgrave, R. L. Obendorf, T. R. Sinclair, P. L. Steponkus

Crop ecology: G. W. Fick, R. B. Musgrave, T. R. Sinclair

Seed physiology and biochemistry: A. A. Khan, R. L. Obendorf

Seed testing and certification: B. E. Clark, W. D. Pardee

Genetic purity of seeds: L. W. Nittler

Crop production: W. R. Knapp, R. F. Lucey, W. D. Pardee, R. R. Seaney, M. J. Wright

Crop stress: P. L. Steponkus

Tropical crops: selected faculty

Weeds and herbicides: W. B. Duke, D. L. Linscott

General meteorology: B. E. Dethier, W. W. Knapp, D. A. Paine

Climatology: B. E. Dethier

Agricultural micrometeorology: E. R. Lemon, T. R. Sinclair

Physical meteorology: W. W. Knapp

Dynamical meteorology: D. A. Paine

Animal Breeding

Graduate Faculty Representative: L. D. Van Vleck, B-22 Morrison Hall

Major and Minor Subjects: Animal Breeding, Animal Genetics

Entering students are expected to have had good basic undergraduate training in biology, chemistry, and mathematics. Previous experience with large animals or with poultry is desirable but not essential.

Graduate Record Examination Aptitude Test scores are recommended but not required.

Graduate students are required to do some teaching during their course of study.

Superior facilities are available for graduate student training in each of the areas listed below. Students are expected to participate actively in these research programs. Some assistantships are available.

Faculty and Specializations

Statistical and quantitative genetics, with particular emphasis on selection programs for improvement of large animals: R. W. Everett, P. A. Oltenacu, R. L. Quaas, L. D. Van Vleck
Reproductive physiology and related areas, and use of various techniques in genetic improvement of populations: R. W. Bratton
Livestock breeding in the tropics: R. E. McDowell
Animal cytogenetics: S. E. Bloom
Immunogenetics: R. R. Dietert

Animal Science

Graduate Faculty Representative: J. Murray Elliot, 262 Morrison Hall

Major and Minor Subjects: Animal Nutrition, Animal Science, Physiology of Reproduction

Preference is given to applicants whose credentials indicate strong undergraduate preparation in both the animal sciences and related biological and physical sciences. It is strongly recommended that applicants resident in the United States prior to application present GRE scores. As part of their training students are required to assist with the teaching program of the Department of Animal Science. The F. B. Morrison Fellowship in Livestock Feeding as well as a number of departmental assistantships are available on a competitive basis to students with appropriate interests.

Depending on specific objectives, applicants may also wish to examine opportunities in the Fields of Nutrition, Physiology, Animal Breeding, and Food Science.

Faculty and Specializations:

R. E. Austic: animal nutrition, amino acids, nitrogen metabolism
R. C. Baker: food science; poultry meat, eggs, and fish
S. E. Bloom: animal cytogenetics
W. F. Brannon: sheep management
W. R. Butler: animal physiology, neuroendocrinology
L. E. Chase: ruminant nutrition
G. F. Combs, Jr.: animal nutrition, nutritional biochemistry
J. M. Elliot: dairy cattle nutrition
R. W. Everett: dairy cattle breeding
D. G. Fox: beef cattle nutrition
R. H. Foote: animal physiology, artificial insemination
R. C. Gorewit: lactation biology, reproductive physiology
W. Hansel: animal physiology and endocrinology
H. F. Hintz: equine nutrition
D. E. Hogue: animal nutrition, sheep
R. E. McDowell: livestock production in warm climates
W. G. Merrill: dairy cattle feeding and management
R. P. Natzke: dairy cattle management, physiology
P. A. Oltenacu: livestock production systems, animal breeding
W. G. Pond: nonruminant nutrition, livestock production
R. L. Quaas: animal breeding, beef cattle
J. T. Reid: animal nutrition, energy metabolism
M. L. Scott: nonruminant nutrition
S. T. Slack: animal nutrition
J. R. Stouffer: meat science, muscle biology
M. L. Thonney: animal nutrition, beef cattle management
H. F. Travis: animal nutrition
P. J. Van Soest: ruminant nutrition, rumen metabolism
A. van Tienhoven: reproductive physiology, neuroendocrinology
L. D. Van Vleck: animal breeding and genetics
R. G. Warner: animal nutrition
R. J. Young: animal nutrition

Anthropology

Graduate Faculty Representative: Davydd J. Greenwood, 226 McGraw Hall

Major Subjects: Since the faculty conceives of its discipline as a unified field, only one major, Anthropology, is offered for the Ph.D. degree. Two subjects are offered at the M.A. level: Anthropology and Archaeology.

Minor Subjects: Applied Anthropology (only for students not majoring in Anthropology), Archaeology, Physical Anthropology, Psychological Anthropology, Social Anthropology. A student may choose training in general anthropology or select one of these subdisciplines as a specialty. Students of social anthropology often concentrate in one of the department's areas of strength: culture and meaning, social organization, and historical anthropology.

A committee consisting of three members of the faculty and a graduate student, with the graduate faculty representative as chairperson, evaluates all applications for admission and awards. All applicants resident in the United States during the year preceding matriculation must submit Graduate Record Examination scores. Those who are accepted, but who are not in the United States at the time of application, must submit scores by the close of their first year at Cornell. Applications should also include a term paper, an honor thesis, or some other sample of written work.

The Field of Anthropology recommends that graduate students seeking a career in anthropology plan to complete a Ph.D. program. Since opportunities for persons holding only the M.A. are limited, applicants who intend to interrupt their studies at the master's level are admitted only under special circumstances.

The deadline for completed applications is January 15.

Every graduate student must pass an examination in at least one literary language other than his or her native language. The student's Special Committee may set additional language requirements.

Every graduate student is expected to gain experience as a teaching assistant.

Faculty and Specializations

Africa: R. A. Borker, V. R. Dyson-Hudson
American Indians: C. F. Hockett
Anthropological history and theory: J. A. Boon, D. J. Greenwood, K. A. R. Kennedy, A. T. Kirsch, J. V. Murra, R. J. Smith
Anthropology and architecture: R. D. MacDougall
Applied anthropology and culture change: M. L. Barnett
Archaeology: J. S. Henderson, T. F. Lynch
Chinese studies: D. R. DeGlopper
Comparative religion: R. A. Borker, A. T. Kirsch, J. T. Siegel
Cross-cultural studies: W. W. Lambert, F. W. Young
Culture and meaning: J. A. Boon, R. A. Borker, B. J. Isbell, A. T. Kirsch, J. T. Siegel
Ecological anthropology: V. R. Dyson-Hudson, J. V. Murra
Economic anthropology: D. J. Greenwood, J. V. Murra
European studies: R. A. Borker, D. J. Greenwood
Expressive culture (art, literature, life histories, anthropological photography and sculpture): R. Ascher, R. J. Smith
Historical anthropology: D. R. DeGlopper, D. J. Greenwood, C. F. Hockett, A. T. Kirsch, J. V. Murra, R. J. Smith
Japanese studies: R. J. Smith
Latin American studies: C. J. Greenhouse, J. S. Henderson, B. J. Isbell, T. F. Lynch, J. V. Murra, F. W. Young
Legal anthropology: C. J. Greenhouse
Linguistics: C. F. Hockett
Oceania: B. Lambert
Physical anthropology: V. R. Dyson-Hudson, J. D. Haas, K. A. R. Kennedy
Psychological anthropology: B. J. Isbell, W. W. Lambert
Social organization: D. R. DeGlopper, D. J. Greenwood, C. F. Hockett, B. Lambert, J. T. Siegel, R. J. Smith
South Asian studies: K. A. R. Kennedy, R. D. MacDougall
Southeast Asian studies: M. L. Barnett, J. A. Boon, A. T. Kirsch, J. T. Siegel
United States society and culture: R. Ascher, C. J. Greenhouse
Urban studies: B. J. Isbell, R. J. Smith
Women's studies: R. A. Borker
Professor-at-Large: Chie Nakane (Institute of Oriental Culture, University of Tokyo, Japan)

For detailed information about policies, curriculum, and sources of financial aid, please request the green brochure from the graduate faculty representative's office.

Applied Mathematics

Graduate Faculty Representative: James H. Bramble, 275 Olin Hall

Major Subject: Applied Mathematics

The graduate program in applied mathematics is based on a solid foundation in pure mathematics which includes the fundamentals of algebra and analysis. It involves a grounding in the methods of applied mathematics and studies of areas in which significant applications of mathematics are made. The field has a broadly based interdepartmental faculty which can direct student programs in a large number of areas of the mathematical sciences.

Many rather specialized or interdisciplinary programs can be designed for the individual student, including, for example, a variety of possibilities in biomathematics.

The program is open to applicants from undergraduate backgrounds that contain a substantial mathematical component. Applicants interested in applied mathematics may also wish to investigate programs offered by the Fields of Computer Science, Mathematics, Operations Research, Statistics, Theoretical and Applied Mechanics, and by various other fields in the physical sciences and engineering.

A candidate for the Ph.D. degree must demonstrate reading knowledge of French, German, or Russian.

The thesis is normally a mathematical contribution toward the solution of a problem arising outside mathematics.

Faculty and Specializations

T. Berger: information theory; statistical communication; random processes
L. J. Billera: game theory; combinatorics; mathematical economics
H. D. Block: biomathematics; artificial intelligence; robots; environmental systems
J. H. Bramble: numerical analysis; partial differential equations
H. J. Carlin: microwave and network techniques
R. L. Constable: theory of computing; automata; logic
J. E. Dennis: numerical mathematics; mathematical programming
R. H. Farrell: mathematical statistics
T. L. Fine: decision theory; comparative probability; speech recognition
M. E. Fisher: foundation and applications of statistical mechanics; combinatorics
W. H. J. Fuchs: mathematical methods of physics
L. Gross: analysis; mathematics of quantum theory
D. C. Heath: applied probability; stochastic control; game theory
J. T. Jenkins: nonlinear field theories in mechanics; continuum mechanics
H. Kesten: probability theory
J. C. Kiefer: probability and statistics
J. A. Krumhansl: solid-state physics; microscopic description of macroscopic properties of materials
S. Leibovich: fluid dynamics; magnetohydrodynamics
S. A. Levin: mathematical biology; differential equations
R. L. Liboff: kinetic theory; plasma physics; electrodynamics; quantum mechanics
W. F. Lucas: game theory; combinatorics

G. S. S. Ludford: fluid and magneto-fluid dynamics; combustion; related mathematical methods
M. K. Majumdar: mathematical economics
A. Nerode: logic; recursive functions and computability; automata
L. E. Payne: partial differential equations
N. U. Prabhu: stochastic processes; analysis and control of stochastic systems
R. H. Rand: differential equations; dynamical systems; biomechanics
S. Rubinow: blood flow; cell proliferation; enzyme kinetics; physiological systems
E. E. Salpeter: theoretical astrophysics; nuclear theory; statistical mechanics
A. H. Schatz: numerical analysis; partial differential equations
S. F. Shen: aerodynamics; rarefied gasdynamics
F. L. Spitzer: probability theory and analysis
R. S. Strichartz: mathematical analysis
M. S. Taqqu: probability; statistics; econometrics; operations research; computer simulation
H. M. Taylor: applied probability and statistics
L. E. Trotter: discrete optimization
C. F. Van Loan: numerial analysis
L. B. Wahlbin: numerical analysis; partial differential equations
L. I. Weiss: statistical decision theory
B. Widom: physical chemistry; statistical mechanics

Applied Physics

Graduate Faculty Representative: Terrill A. Cool, Clark Hall

Major and Minor Subject: Applied Physics

Graduate study in the field offers the opportunity to achieve proficiency in physics, mathematics, and applied science. Applied physics is particularly suitable for students preparing for a scientific career in areas of applied science based on principles and techniques of physics.

A student may choose for specialization and thesis research any subject compatible with an approach based on the application of principles of physics and mathematics.

Current areas of advanced study and research include: applied theoretical physics, biophysics, chemical physics, cryogenics, physics of fluids, nuclear and reactor physics, optics, plasma physics, radiation and matter, solid-state physics and materials science, space physics, and surface physics. Additional details about current programs are given in brochures obtainable from the graduate faculty representative.

Students in applied physics usually receive some sort of financial aid during their entire graduate study program, including summers. Most students serve as research assistants at least during the period of thesis research.

For applicants for the M.S. or Ph.D. degree program, undergraduate preparation in physics or another physical science, or in an engineering field with strong emphasis on mathematics and modern physics, provides appropriate preparation. Submission of Graduate Record Examinations scores is strongly suggested.

In addition to the examinations required by the Graduate School, every student in the Ph.D. program takes a written qualifying examination, covering the core course program, after three semesters of graduate study.

A professional degree program leading to the degree of Master of Engineering (Engineering Physics) offers students the opportunity to master advanced topics in physics and extend their skills in their chosen engineering specialties.

Faculty

D. Ast, P. L. Auer, J. M. Ballantyne, R. W. Balluffi, B. W. Batterman, S. H. Bauer, J. M. Blakely, R. A. Buhrman, K. B. Cady, D. D. Clark, R. K. Clayton, T. A. Cool, P. C. T. de Boer, F. D. Drake, L. F. Eastman, M. E. Fisher, H. H. Fleischmann, P. L. Hartman, M. O. Harwit, J. R. Houck, B. L. Isacks, H. H. Johnson, V. O. Kostroun, E. J. Kramer, J. A. Krumhansl, A. F. Kuckes, B. R. Kusse, C. A. Lee, A. Lewis, C. Li, R. L. Liboff, R. V. E. Lovelace, R. McFarlane, P. R. McIsaac, J. K. Moffat, J. A. Nation, M. Nelkin, J. E. Oliver, E. Ott, E. L. Resler, Jr., T. N. Rhodin, A. L. Ruoff, M. M. Salpeter, D. N. Seidman, B. M. Siegel, J. Silcox, R. Spanswick, R. N. Sudan, C. L. Tang, D. L. Turcotte, W. W. Webb, C. B. Wharton, G. J. Wolga

Architecture

Graduate Faculty Representative: Charles W. Pearman, 129 Sibley Hall

Major and Minor Subjects: Design (architectural design, urban design, regional design); Architectural Science (applied behavioral science, environmental technology, architectural structures, industrialized building, computer applications)

Graduate study in the Field of Architecture may be pursued in design leading to the Master of Architecture degree or in architectural science leading to the degree of Master of Science. Study in architectural history is offered in the Field of History of Architecture and Urban Development. There is a joint degree program with the Field of City and Regional Planning. Every applicant for graduate work is expected to select and identify in advance the intended program of study.

Foreign students whose undergraduate training has been completed outside the United States are admitted to provisional candidacy. They should plan to spend at least four terms in residence for the master's degree.

Design

Students who have satisfactorily completed an accredited undergraduate professional program with the Bachelor of Architecture degree may be admitted as candidates for the degree of Master of Architecture. Those who have completed four years of a six-year degree program with a major in architecture or environmental design, or have yet to receive a qualifying professional degree, should apply as transfer students to the undergraduate program since the Bachelor of Architecture is the qualifying degree at Cornell. Upon fulfilling the requirements for the

Bachelor of Architecture degree, they may be admitted to the graduate program.

Three areas of major concentration are offered: architectural design, urban design, and regional design. These areas are each sufficiently broad to verge on one another while focusing in general on the scale of problems suggested by the designation. It is assumed that each student will develop an elective program to reinforce and supplement the studio work.

Normally four terms of study are required, and the student should not anticipate completing studies in less than this time, although in special cases the requirements for the degree may be completed within a three-semester period.

The programs leading to the Master of Architecture degree are administered by Program Concentration Committees, consisting of the graduate faculty representative and those faculty offering work in the area of concentration. The Special Committee includes two advisers in the area of major concentration and one adviser in the area of minor concentration. The thesis is directed by the Special Committee with an additional member at the student's option.

Architectural Science

Students with undergraduate degrees in architecture, architectural engineering, behavioral science, or the various branches of engineering, are likely candidates for the graduate program in architectural science. Its objectives are (1) to afford an opportunity for students of architecture to expand their creative design potential by increasing their knowledge and understanding of environmental science and building technologies; (2) to provide a framework within which students graduating in related scientific technical disciplines can explore building science and technology related specifically to architecture; and (3) to provide a framework within which the student graduating in related behavioral science areas can explore the application of these disciplines in an architectural context.

Ordinarily four terms of residence will be required to complete the program of study, depending on the student's background and experience.

Faculty and Specializations

R. W. Crump: environmental controls
D. P. Greenberg: architectural technology, structural analysis and design, suspension structures, computer graphics, model analysis
A. Kira: human engineering and psychological aspects of architecture
R. MacDougall: anthropological methods applied to architecture
K. C. Parsons: urban design, land use, institutional planning, history of collegiate architecture
C. W. Pearman: architectural design, urban design, regional design, housing, building systems
J. W. Reps: planning administration, history of city planning in the United States and Europe, development of urban America, design character of American cities
C. Rowe: history of Renaissance and modern architecture, urban design, architectural criticism, contemporary European and American architecture
F. W. Saul: structural steel and reinforced concrete building design, structural plastics and blast-resistant design
M. Schack: architectural design, urban design
J. P. Shaw: architectural design, urban design, regional design
D. M. Simons: computer applications, architectural design
S. W. Stein: urban design, site planning, urban renewal, housing
O. M. Ungers: housing, urban design, regional design
J. A. Wells: urban design, housing, building systems

Faculty for the M. Arch. Degree Only
S. Bowman: visual communication systems
M. Dennis: architectural design, urban design
M. Harms: architectural design
G. Hascup: architectural design
L. F. Hodgden: architectural design, theory and criticism
U. Lesnikowski: architectural design
W. G. Lesnikowski: housing, building systems
A. MacKenzie: architectural design methods, urban design

Art

Graduate Faculty Representative: Jason Seley, The Foundry

Major and Minor Subjects: Graphic Arts, Painting, Sculpture

Applicants must have a bachelor's degree or its equivalent and must clearly demonstrate professional promise in art by submission of ten selected slides. Further information is available from the graduate faculty representative.

This field offers only the degree of Master of Fine Arts (M.F.A.). The M.F.A. program requires four terms of residence and is intended for those who wish to further their education as artists. Candidates must complete fifteen credit hours of courses in the history of art, either as graduate or as undergraduate students, and must take at least twelve hours of academic work outside the Department of Art.

The faculty is composed of practicing artists who teach rather than teachers who practice art. The entire resident faculty and the visiting critics are available to give criticism to graduate students.

The buildings that house the programs are open twenty-four hours a day; they are adjacent to the Fine Arts Library (61,000 volumes) and next door to the University's Herbert F. Johnson Museum of Art.

Each candidate in the program in painting or sculpture is required to present his or her own exhibition at the end of the third term. For painting students, the principal effort of the fourth term is a thesis painting demonstrating creative ability and technical proficiency. Graduate painting is under the direction of the painting staff. Students work in private studios in Franklin Hall. Graduate sculpture is under the direction of Professors Colby, Seley, and Squier. The

sculpture program has its own building, a 45- by 180-foot converted foundry with 14-foot ceilings. Separate studios, complete gas- and arc-welding facilities, heavy-duty grinders, a drill press, a band saw, and a variety of portable power tools are provided. Graduate students in the graphic arts program study the various techniques, including relief, intaglio, lithography, and various photographic processes. Experiment and tradition, theory, history, and practice are part of the program. Graduate graphic arts is under the direction of Professors Singer, Poleskie, and Thompson. The program's facilities in Franklin Hall include etching presses, lithographic presses, and proof presses.

Faculty

Z. Blum, S. J. Bowman, V. E. Colby, L. Dunkelman, K. W. Evett, G. Pederson-Krag, S. Poleskie, J. L. Seley, A. Singer, J. L. Squier, H. Steinbach, P. Thompson

Asian Studies

Graduate Faculty Representative: Brett deBary, 123 Rockefeller Hall

Major Subject: East Asian Studies (for M.A. and M.P.S. only)

Minor Subjects: Asian Studies, East Asian Linguistics, South Asian Linguistics, Southeast Asian Linguistics

For Ph.D. candidates Asian studies is available as a minor field of concentration for students admitted in a major field of the Graduate School. The Ph.D. candidate may select a minor in the field consisting of either *(a)* concentrated interdisciplinary study of one area of Asia, or *(b)* disciplinary or topical concentration that cuts across area boundaries. Because specialization in Asia usually involves the study of an Asian language, it is essential that the candidate discuss the problem of language work with the entire Special Committee, particularly with the member representing the major field.

Major and minor work is also offered in various social science fields and in Oriental art, in East Asian literature, in medieval or modern Chinese history, and in Southeast Asian history.

M.A. and M.P.S. candidates may major in East Asian studies. This program is designed for students whose career goals require only the M.A. or M.P.S. degree as well as for those who wish to continue in a major Ph.D. field but do not have the necessary language or area background.

Proficiency in speaking and reading Chinese or Japanese is required for the M.A. degree. Candidates who have never studied an East Asian language will be expected to complete Cornell's FALCON Program. This program offers full-time, intensive language training in Chinese and Japanese. Thereafter each candidate must complete one year of full-time study (normally four courses each semester), at least one half of which will be within one particular discipline and all of which will be related to the Field of Asian Studies. Students who at entrance already have some language training, will have language programs individually designed for their particular needs, and may, if they are advanced enough, complete the M.A. or M.P.S. requirements in as little as one academic year. The M.A. requires a thesis; the Master of Professional Studies (East Asia) [M.P.S. (E.A.)] does not.

There are at Cornell three programs concerned with teaching and research on Asia—the China-Japan Program, South Asia Program, and Southeast Asia Program (see pp. 17, 19). The National Defense Education Act supports, at Cornell a language and area center in Southeast Asia.

Languages currently offered at Cornell are Burmese, Cambodian, Cebuano, Chinese (Mandarin, Cantonese, and Hokkien), Hindi-Urdu, Indonesian, Japanese, Javanese, Malay, Pali, Sanskrit, Sinhalese, Tagalog, Tamil, Telegu, Thai, and Vietnamese.

Graduate students in Asian studies are eligible for the Foreign Language and Area Studies (formerly NDFL) Fellowships offered by the United States Office of Education; application forms should be requested from the Graduate School. They are also eligible for the Foreign Area Training Fellowships administered by the Social Science Research Council for study in the United States and for research overseas. Qualified graduate students who are citizens of the United States may apply for Fulbright research awards for Taiwan, India, Indonesia, Japan, Malaysia, Pakistan, Philippines, and Thailand.

For additional details, consult the Department of Asian Studies, 156 Rockefeller Hall.

Faculty and Specializations

China
N. C. Bodman: lingusitics
D. R. DeGlopper: anthropology
J. McCoy: linguistics and literature
T. L. Mei: literature and philosophy
D. Mozingo: government; international relations
C. A. Peterson: medieval history
M. W. Young: art history

Japan
K. Brazell: literature
B. deBary: literature
R. T. Freeman: economics
E. H. Jorden: linguistics
R. J. Smith: anthropology
M. W. Young: art history

South Asia
D. E. Ashford: government; public administration
A. T. Dotson: government
E. C. Erickson: rural sociology
J. W. Gair: linguistics
M. D. Glock: educational psychology
G. B. Kelley: linguistics
K. A. R. Kennedy: anthropology
J. W. Mellor: agricultural economics
G. M. Messing: classics and linguistics
S. J. O'Connor: art history
T. T. Poleman: agricultural economics

Southeast Asia
B. R. O'G. Anderson: government
M. L. Barnett: development sociology
A. T. Dotson: government

J. M. Echols: linguistics and literature
F. H. Golay: economics
F. E. Huffman: linguistics
R. B. Jones, Jr.: linguistics
G. McT. Kahin: government
A. T. Kirsch: anthropology
S. J. O'Connor: art history
J. T. Siegel: anthropology
J. U. Wolff: linguistics
O. W. Wolters: history
D. K. Wyatt: history

Visiting Professors
Southeast Asia: Alexander B. Griswold, Breezewood Foundation; D. G. E. Hall, Professor Emeritus, London University

Astronomy and Space Sciences

Graduate Faculty Representative: Yervant Terzian, 428 Space Sciences Building

Major and Minor Subjects: Astronomy, Astrophysics, Planetary Studies, Radiophysics, Space Sciences (General)

Students admitted to this field must have a strong background in electrical engineering, engineering physics, mathematics, or, especially, physics. The Graduate Record Examinations, including the Advanced Test in Physics, are required and often are of great help in admitting outstanding students from less well-known institutions.

Research Opportunities

Members of the staff are particularly interested in directing graduate research in the following subjects.

Astronomy and astrophysics: cosmic rays; relativity and cosmology; dynamics of the interstellar gas; solar system dynamics and magnetohydrodynamics; theory of stellar structure; stellar evolution; nuclear astrophysics; stellar systems and stellar statistics; gravitational theory; X-ray sources; black holes; chemistry of the interstellar medium

Atmospheric and ionospheric radio investigations: dynamics of the atmosphere and ionosphere; incoherent electron scattering; refraction, scattering, and attenuation due to the inhomogeneous nature of the troposphere and ionosphere; propagation of radiowaves in ionized media

Radio astronomy: distribution and classification of radio sources; radar investigations of the moon and planets; solar radio observations; studies of gaseous nebulae; interstellar radio lines; radio-galaxies, quasars, pulsars

Space vehicle instrumentation: instrumentation relating to lunar and planetary exploration; magnetic field measurements; tenuous gas and particle flux measurements; infrared observations from rockets

Infrared astronomy: studies of dust clouds, ionized hydrogen regions, and cosmic background; development of novel spectrometric techniques; observations from high altitude balloons and aircraft

Lunar studies: simulations of the lunar surface; analysis of samples returned by Apollo crews; spacecraft investigations of the moon; studies of the lunar interior and origin

Planetary studies: observational, theoretical, and laboratory studies of planetary atmospheres and surfaces; observations from high altitude aircraft; spacecraft investigations such as Mariner, Viking, and earth orbital missions; exobiology and prebiological organic chemistry; dynamics of planetary atmospheres

Graduate students in this field may be connected with the Cornell University Center for Radiophysics and Space Research, which possesses and is planning important facilities for geophysical and solar system investigations both by radio methods and by space vehicle instrumentation. The center operates the Infrared Laboratory, the Lunar Laboratory, and the Laboratory for Planetary Studies. Center personnel use large optical telescopes in the American southwest. Students may also be connected with the Cornell-operated National Astronomy and Ionosphere Center, Arecibo, Puerto Rico, the largest radio telescope in the world. Students often conduct thesis research at Arecibo or at other major radio observatories.

Further details of the above organizations and facilities are available in special brochures and can be obtained by writing to the respective organizations or to the Graduate Faculty Representative, Astronomy and Space Sciences, Cornell University, Space Sciences Building, Ithaca, New York 14853.

Faculty and Specializations

J. A. Burns: celestial mechanics; solar system physics
D. B. Campbell: radio and radar astronomy
F. D. Drake: solar system; radio astronomy; extraterrestrial life
J. L. Elliot: optical astronomy; planetary studies
D. T. Farley: ionospheric physics; electrical engineering
P. Gierasch: planetary atmospheres; geophysical fluid dynamics
T. Gold: lunar studies; solar system research; cosmology
K. I. Greisen: high-energy astrophysics; X-ray and gamma-ray astronomy
M. O. Harwit: infrared astronomy; interstellar and interplanetary dust; optical transform techniques
J. R. Houck: infrared astronomy; interstellar and interplanetary dust; diffuse nebulae
R. V. E. Lovelace: plasma astrophysics; galactic structure
J. M. Rankin: radio astronomy
C. Sagan: planetary studies and exobiology
E. E. Salpeter: theoretical physics and theoretical astrophysics
S. L. Shapiro: theoretical astrophysics
R. N. Sudan: plasma physics
Y. Terzian: interstellar matter; radio astronomy
S. A. Teukolsky: relativistic astrophysics
J. Veverka: planetary studies; lunar studies

Professor-at-Large: Sir Fred Hoyle

Biochemistry, Molecular and Cell Biology

Graduate Faculty Representative: David B. Wilson, G-22 Wing Hall

Major and Minor Subjects: Biochemistry, Molecular and Cell Biology

Prior training should include calculus, physics, and chemistry sequences through introductory physical chemistry. The Graduate Record Examinations Aptitude Test and Advanced Test in Chemistry (preferred) or Biology are required.

Ph.D. candidates are required to teach for at least two semesters. The field has no foreign language requirement but a student's Special Committee may require proficiency in a foreign language.

Ph.D. candidates who intend to minor in biochemistry should consult with a member of the field as soon as possible. Although the intermediate biochemistry sequence (including the laboratory course) normally constitutes the course work requirement for the minor, other courses may be substituted at the discretion of the student's adviser.

Faculty and Specializations

W. J. Arion: structure, function and regulation of the hepatic glucose-6-phosphatase system; metabolite transport systems in the hepatic and renal endoplasmic reticulum
J. M. Calvo: control of metabolic pathways in bacteria; bacterial genetics
T. C. Campbell: role of nutrition in chemical carcinogen metabolism; adducts of carcinogen metabolites and macromolecules
W. L. Dills: mammalian fructose metabolism; metabolic effects of monosaccharide derivatives
S. J. Edelstein: structure and function of proteins; analytical ultracentrifugation; electron microscopy and image reconstruction
G. W. Feigenson: lipid-protein interaction; membrane structure using NMR
G. R. Fink: regulation of histidine biosynthesis in yeast
J. Gibson: growth regulation and membrane function in photosynthetic procaryotes
Q. H. Gibson: haemoproteins; flavoproteins; rapid reaction spectrophotometry; physical methods in enzyme kinetics
G. G. Hammes: biophysical chemistry, especially enzyme kinetics and mechanisms
L. A. Heppel: nucleic acid biochemistry; transport and energy coupling in bacteria; membrane properties of tumor cells
G. P. Hess: protein chemistry; chemical and kinetic studies of interrelationship of structure and function in proteins, with special reference to acetylcholine receptor-mediated ion flux
P. C. Hinkle: mitochondrial ion transport and oxidative phosphorylation
A. T. Jagendorf: electron transport and phosphorylation mechanisms in chloroplasts; synthesis of chloroplast proteins
E. B. Keller: Messenger RNA synthesis on DNA and its utilization for protein synthesis
J. T. Lis: control of gene expression in Drosophila
R. E. MacDonald: Microbial membrane transport; energy coupling; regulation of cell growth
J. T. Madison: amino acid and protein synthesis in plants
R. E. McCarty: photosynthetic phosphorylation and electron transport
D. B. McCormick: vitamins, coenzymes, metal ions; enzyme mechanisms
J. K. Moffat: X-ray determination of protein structure; the relationship between structure and function in hemoglobin and calcium binding proteins
E. Racker: mechanisms of enzyme action; control mechanism, structure, and function in mitochondria and chloroplasts; mechanisms in bioenergetics
J. W. Roberts: biochemistry of genetic control
J. F. Thompson: mechanisms and controls of storage protein synthesis in legume seeds; nitrogen and sulfur metabolism of plants
Bik-Kwoon Tye: mechanism and regulation of DNA replication
V. Utermohlen: cell-mediated immunity and slow virus diseases; fatty acids and immunity
V. M. Vogt: structure and assembly of tumor viruses; gene expression in slime molds
D. B. Wilson: biochemical genetics; membrane transport
J. F. Wootton: enzyme chemistry; relationships between structure and function
L. D. Wright: biosynthesis of biologically active compounds; mevalonic acid metabolism; biotin metabolism
R. Wu: nucleotide sequence analysis of phage and viral DNA; control of enzyme and DNA synthesis in eucaryotic cells
D. B. Zilversmit: lipid and lipoprotein transport; membrane structure; atherosclerosis

Botany

Graduate Faculty Representative: W. J. Dress, 467 Mann Library, L. H. Bailey Hortorium

Major and Minor Subjects: Botany (biosystematics, cytology, evolutionary botany, paleobotany, phycology, plant ecology, plant morphology and anatomy, plant physiology, plant taxonomy)

Applicants from North America are required to provide scores of the Graduate Record Examinations. A combined verbal and quantitative score of at least 1200 is normally required. Students wishing to major in plant physiology are advised to obtain a background in calculus, inorganic and organic chemistry, and physics before entry.

All candidates will normally take an oral prescriptive examination during the first semester of residence. The Field of Botany has no language requirement but individual advisers may require proficiency in two languages for the Ph.D. degree and one language for the master's degree.

Research Facilities

The field offers facilities for all research programs related to the special interests of its faculty. Modern instrumentation, ranging from spectrophotometers to electron microscopes, is routinely available as are growth and culture chambers and greenhouse facilities. The library is well stocked in botanical volumes and the herbaria collectively represent one of the nation's major systematics resources. Cornell owns many nearby areas available for student research.

Most of them are undeveloped and include a variety of habitats; some however, such as the experimental ponds, are developed for specific research needs.

Students majoring in plant physiology will be able to obtain training leading to professional competence in the physiology, biochemistry, biophysics, or cellular biology of plants. Research may be directed toward fundamental science or toward the interface between theory and agricultural or oceanographic applications.

Requirements for Majors in Plant Physiology

In addition to advanced courses in the three main areas of plant physiology (water and ion movements, plant biochemistry, and plant development), degree requirements include a minimum of one intermediate or higher-level course in three other relevant biological subjects (i.e., genetics, cytology, plant morphology, animal physiology, cell biology, ecology, microbiology, plant pathology) and one course in each of two supporting fundamental sciences (usually biochemistry and either organic or physical chemistry, biophysics, or relevant parts of mathematics, including computer science). These requirements may coincide in part with those of the minor subjects or may be satisfied by courses taken before entry.

In addition to one major and two minor professors, each Ph.D. candidate will have a fourth voting member appointed by the plant physiologists to the Special Committee.

Faculty and Specializations

D. M. Bates: biosystematics and evolution of flowering plants; ethnobotany
N. A. Campbell: structure and function of cells specialized for rapid ion transport
B. F. Chabot: physiological ecology and population biology
R. K. Clayton: physical and photochemical mechanisms in photosynthesis
L. L. Creasy: physiology and biochemistry of plant phenolics
P. J. Davies: mode of action and transport of plant hormones; regulation of development, flowering, and senescence in higher plants
W. J. Dress: systematics and nomenclature of flowering plants
D. C. Elfving: water relations; fruit tree growth control
E. E. Ewing: physiology of tuberization with emphasis on hormonal control; starch-sugar equilibria in potatoes as related to enzymes and nucleic acid metabolism
J. W. Ingram, Jr.: systematics of flowering plants with emphasis on anatomical approaches
A. T. Jagendorf: electron transport, phosphorylation, ion fluxes and gradients in chloroplasts; protein synthesis in plastid development
J. M. Kingsbury: phycology; aquatic and marine ecology; phytotoxicology
R. P. Korf: systematics and nomenclature of fungi, lichens, and mycetozoa
P. L. Marks: plant ecology
H. E. Moore, Jr.: systematics of flowering plants, especially the Palmae and the Monocotyledoneae in general
R. L. Obendorf: physiology and biochemistry of cold sensitivity during germination, seeding development, and seed formation
D. J. Paolillo, Jr.: developmental plant morphology and anatomy
M. V. Parthasarathy: phloem structure and function; plant anatomy and cytology
L. E. Powell, Jr.: plant hormones; shoot growth and dormancy; growth and development, especially of woody plants
T. R. Sinclair: increase in plant productivity, especially of soybeans, by improving CO_2 assimilation rates, nitrogen fixation rates, and water-use efficiency
R. M. Spanswick: ion transport; electrophysiology of plant cell membranes; physiological determinants of yield
P. L. Steponkus: stress physiology; biochemical mechanisms of cold acclimation; freezing injury; high-temperature injury and senescence; drought resistance
J. F. Thompson: reactions and control mechanisms in amino acid biosynthesis; protein synthesis
H. B. Tukey, Jr.: physiology and growth regulation of higher plants; nutrition, uptake, and loss of substances by plants
C. H. Uhl: chromosomes and cytotaxonomy
M. D. Whalen: biosystematics and chemotaxonomy of the Solanaceae
R. H. Whittaker: plant communities

Business and Public Administration

Graduate Faculty Representative: L. Joseph Thomas, 503 Malott Hall

Major and Minor Subjects: Managerial Economics, Organization Theory and Behavior, Quantitative Analysis for Administration, Accounting, Business Policy, Business and Public Policy, Finance, International Development, Marketing, Medical Care Organization and Administration, Production and Operations Management, Public Administration

The most desirable preparation is strong undergraduate work in such relevant fields as economics, government, sociology, psychology, mathematics, or engineering; plus a distinguished record in a program leading to the M.B.A. or M.P.A. degree, or the equivalent. Students are also admitted directly from a bachelor's degree program. A knowledge of mathematics at least through calculus is desirable. Students may not register for an M.A. or M.S. degree in this field; those desiring a master's degree should examine the *Announcement of the Graduate School of Business and Public Administration.*

Applicants, both foreign and domestic, must submit aptitude test scores for either the Graduate Management Admission Test (GMAT) or the Graduate Record Examinations.

The Ph.D. program in this field is intended to prepare students for teaching and research in administration in the context of one or more of the institutional frameworks involved—business, government, health care. Unlike the professional M.B.A. and M.P.A. programs, its primary task is not to prepare practitioners.

A considerable number of assistantships and several fellowships are awarded annually.

Subject Descriptions

Managerial Economics concentrates on economic analysis for decision making. A candidate may study the problems of the total economy, of industries, or of the firm, and may do so within the context of any particular study area, such as international economic relations, economic development, business-government relations, money and banking, investment project analysis, or transportation.

Organization Theory and Behavior focuses on social and behavioral science approaches to the study of human activity in organizational settings. The major concern is with regularities, differences, and relationships in purposive behavior. A fundamental grounding in at least one of the basic behavioral disciplines is essential.

Quantitative Analysis for Administration stresses the modern developments in the uses of mathematical and statistical tools and computer technology for the solution of managerial problems.

Accounting deals with the theory and practice of developing financial data for two purposes: to enable management to control and plan the development of the enterprise and to enable others to appraise its condition.

Business Policy involves the study of business corporations, and particularly of the strategy developed to meet various problems, both internal and external. Knowledge of marketing, production, finance, personnel and labor relations, and accounting is essential.

Business and Public Policy involves the study of the three-way relationship among individuals, business firms, and government. Emphasis is placed on the impact of public policies and regulations on business and of business policies on government.

Finance focuses on the financial structures and requirements of corporations of various types, the problems of maintaining sound financial condition, the organization and behavior of financial markets of different types, and the influence of public policies on these markets and on corporate finance. A knowledge of accounting is essential.

International Development deals with the problems of establishing effective public and business institutions in developing parts of the world, with special emphasis on problems of both public and private administration. A good background in one or more of the basic disciplines of economics, government, sociology, or anthropology is highly desirable.

Marketing is the study of how the analytical tools derived from economics, psychology, sociology, and operations research can be applied in marketing and in appraising markets. Potential areas of study range from analysis of consumer behavior to research in the decision-making process in the management of marketing organizations.

Medical Care Organization and Administration comprises the study of the problems of public policy and administration associated with organization, financing, and delivery of personal health services. Health services are studied employing a systems framework.

Production and Operations Management emphasizes the study of quantitative methods of analysis, including the use of the computer, in the solution of major economic decision problems of production and operations management.

Public Administration involves an interdisciplinary approach to the study of governmental policies, policy formulation, power relationships, administrative behavior, basic management functions, and the broad environment of public affairs. Competence in bureaucratic and organizational theory and in the methods of the social sciences is expected.

Faculty

D. M. Ahlers, D. E. Ashford, D. M. Barton, R. M. Battistella, F. T. Bent, H. Bierman, E. Brooks, J. B. Bugliari, C. S. Craig, H. J. Davidson, A. T. Dotson, R. E. Dukes, T. R. Dyckman, M. J. Esman, E. S. Flash, Jr., J. E. Hass, S. Kelman, D. C. Knapp, A. J. Kover, R. C. Lind, T. M. Lodahl, A. K. McAdams, J. M. McCann, J. O. McClain, V. R. Rao, A. Rudd, T. Rundall, S. Smidt, R. Smiley, R. J. Swieringa, D. A. Thomas, L. Joseph Thomas, K. E. Weick

Chemical Engineering

Graduate Faculty Representative: Peter Harriott, 101 Olin Hall

Major and Minor Subjects: Biochemical Engineering, Chemical Engineering (general), Chemical Microscopy, Chemical Processes and Process Control, Materials Engineering, Kinetics and Transport Processes

Although most applicants will have satisfactorily completed the equivalent of the fundamental work required by an accredited curriculum in chemical engineering, outstanding students with undergraduate majors in chemistry, physics, microbiology, materials science, etc. are encouraged to apply. Such students will normally require an extra semester or summer term of residence.

Chemical engineering (general) is required of all students, either as a major or as a minor. Candidates are expected to pursue study and research that will give them a deeper comprehension of the basic and applied sciences and will develop initiative, originality, and creative ability. Theses may involve either experimental research or special projects in such subjects as design, economics, and mathematical analysis. There is no language requirement for students majoring in chemical engineering.

Faculty and Specializations

C. Cohen: polymer solutions; light scattering to investigate properties of liquids and solids

G. G. Cocks: light and electron microscopy; structure and properties of materials (particularly gels and biomaterials); crystallography

R. K. Finn: fermentation kinetics; agitation and aeration; microbial polysaccharides; chemical waste treatment
K. E. Gubbins: classical and statistical thermodynamics of liquid mixtures; prediction of multicomponent phase equilibria; transport properties; computer simulation of liquids
P. Harriott: kinetics and catalysis; process control; diffusion in membranes and porous solids
R. Merrill: surface chemistry and physics; scattering of electrons, atoms, and molecules from solids; catalysis corrosion; adhesion
F. Rodriguez: polymerization; properties of polymer systems
G. F. Scheele: hydrodynamic stability; coalescence; fluid mechanics of liquid drops and jets
M. L. Schuler: food production; immobilized microbes; microbial growth and interaction; growth of plant cells; mathematical models of cells
J. C. Smith: heat transfer; mixing; mechanical separations
J. F. Stevenson: transport phenomena; polymer rheology; medical applications of chemical engineering
R. G. Thorpe: phase equilibria; fluid flow; kinetics of polymerization
R. L. Von Berg: liquid-liquid extraction; reaction kinetics; effect of radiation on chemical reactions; saline-water conversion
H. F. Wiegandt: crystallization; petroleum processing; saline-water conversion; direct contact heat transfer

Chemistry

Graduate Faculty Representative: M. J. Goldstein, 328 Baker Laboratory

Major and Minor Subjects: Analytical Chemistry, Bioorganic Chemistry, Biophysical Chemistry, Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Theoretical Chemistry

With the consent of the Special Committee, a student may elect one or two minors from the above list or from another field.

Applicants for the Ph.D. and M.S. programs should have the equivalent of an A.B. degree with a major in chemistry, including courses in organic, inorganic, analytical, and physical chemistry as well as mathematics and physics. Unusually promising students may be admitted with deficiencies in undergraduate training, but will have to make up the deficiencies. Applicants should take the Graduate Record Examinations Aptitude (Verbal and Quantitative) Tests and Advanced Test in Chemistry.

The program of graduate study is designed to give broad training in the fundamental knowledge of chemistry and in methods of research. Graduate students will ordinarily pursue these objectives by taking advanced courses, by participation in organized and informal seminars and discussions with their associates and faculty members, and by carrying out and reporting on research projects in their major subjects.

Graduate students normally carry on research during the summer, and receive financial support for this purpose.

Entering graduate students are required to register with the Department of Chemistry on the registration days at the beginning of their first term. They will consult with the chairperson of the department and with their temporary Special Committees.

Proficiency tests in analytical, inorganic, organic, and physical chemistry will be required of all entering M.S. and Ph.D. candidates. A proficiency test in biochemistry is offered for students who plan to carry on related work. These tests are given a few days before registration for the fall term. Results will be used to help the student's Special Committee plan the student's program. Remedial course work may be required of students with poor test scores.

Teaching experience is an essential part of graduate education in chemistry. The nature and the duration of this experience are established through consultation between the student and the Special Committee in accordance with field recommendations.

Majors in organic and bioorganic chemistry must demonstrate their ability to translate published material in these subjects from the German with the aid of a German-English dictionary. This examination is offered in the same period as the other proficiency examinations. It must be passed prior to the thesis examination. Majors in these areas are also required to pass two cumulative examinations prior to their Admission to Candidacy Examination and eight examinations prior to their thesis examination. Eight such examinations are offered during each academic year and two each summer.

Specific inquiries from prospective graduate students are welcomed and should be addressed to the graduate faculty representative or to any member of the faculty. Applications for teaching assistantships should be addressed to the graduate faculty representative. A brochure entitled *An Introduction to Graduate Study in Chemistry* is available from the graduate faculty representative. The brochure states in some detail the varied research interests of the chemistry faculty.

Faculty and Specializations

A. C. Albrecht: physical
J. M. Burlitch: inorganic, organic
B. K. Carpenter: inorganic, organic
E. L. Elson: biophysical, physical
R. C. Fay: inorganic
M. E. Fisher: theoretical
J. H. Freed: physical, theoretical
B. Ganem: bioorganic, organic
M. J. Goldstein: organic
E. R. Grant: physical
G. G. Hammes: biophysical, physical
R. Hoffmann: theoretical
P. L. Houston: physical
R. E. Hughes: physical
G. M. Loudon: bioorganic, biophysical, organic
F. W. McLafferty: analytical, organic, physical
J. Meinwald: bioorganic, organic
G. H. Morrison: analytical
E. L. Muetterties: inorganic, organic
R. F. Porter: inorganic, physical
L. W. Que: inorganic

T. Rhodin: physical
H. A. Scheraga: biophysical, physical
A. G. Schultz: organic
M. F. Semmelhack: inorganic, organic
M. J. Sienko: inorganic, physical
D. A. Usher: bioorganic, biophysical, organic
B. Widom: physical, theoretical
J. R. Wiesenfeld: physical
C. F. Wilcox, Jr.: bioorganic, organic, theoretical

City and Regional Planning

Graduate Faculty Representative: William W. Goldsmith, 200 West Sibley Hall

Major Subjects: City and Regional Planning, Planning Theory and Systems Analysis, Regional Science, Urban Planning History, Urban and Regional Theory

Minor Subjects: Environmental Planning and Design, Planning Theory and Systems Analysis, Regional Economics and Development Planning, Regional Science, Social and Health Systems Planning, Urban Planning History, Urban and Regional Theory

All applicants resident in the United States during the year preceding matriculation must submit scores of the Graduate Record Examinations Aptitude Test taken within the previous two years.

The field offers a program leading to the professional degree of Master of Regional Planning (M.R.P.), a program leading to the Ph.D. degree, and participates in the program leading to the Master of Professional Studies (International Development) [M.P.S.(I.D.)], with a concentration in regional planning.

Students may apply for the master's program or for the doctoral program as master's degree candidates. Applicants with previous graduate work equivalent to one year or more in the Cornell M.R.P. program will be considered for advanced standing or direct admission to doctoral study. Master's degree candidates may apply for transfer to the Ph.D. program after completing two semesters or after taking the M.R.P. degree.

The department awards a limited number of teaching and research assistantships. It also administers a number of special programs funded through outside sources. For example, for the past four years it has run a successful HUD work/study program which provided complete support to several students.

Aims and Operations of the Field

City and regional planning is broadly concerned with social decision-making processes: the formation of public policies, the design and evaluation of programs, the development of institutions, and the creation of legislative and administrative implementation devices. These concerns reflect a general view of planning that can be applied to a number of areas: urban physical development; health, welfare, education, manpower, housing, and recreation systems; and the development of lagging regions and regions in Third World nations. This view of planning entails the use of theoretical and analytical tools developed for the study of social and economic systems and the relationships between them.

Within this broad framework, students have considerable flexibility in pursuing their own areas of interest. It is possible to develop programs of study that may vary across a wide spectrum, from those that have a very general approach to planning to those with a more specialized focus. Some current areas of specialization of interest to the faculty are: urban planning history; historic area preservation; urban development policies and programs; legal aspects of planning; land-use planning; planning design; science, technology, and urban development; ecological planning; sociology of urban communities; planning politics and administration; institutional and campus planning; social policy planning; regional analysis and development planning; urban and environmental systems planning; housing; health planning; and nonmetropolitan planning.

Doctor of Philosophy

A master's degree with course work equivalent to that required in the first year of the graduate programs in planning at Cornell is ordinarily required for admission to candidacy for the Ph.D. degree. Applicants who hold the master's degree in a related field and have had acceptable experience in planning practice or have completed substantial graduate-level course work in planning may be considered for admission. Such candidates may be required to take additional work at the master's level.

Work for the Ph.D. is considered preparatory to making creative contributions to the field. For that reason, substantial competence and knowledge of basic analytical and research methods will be required. Candidates may fulfill this requirement by preparation previous to entrance or by course work at Cornell that may be in a minor subject.

In consultation with the chairperson of his or her Special Committee, the Ph.D. candidate will normally select two minor subjects that best complement the research interests in city and regional planning. Minor work is possible in such subjects as aerial photographic studies, agricultural economics, applied anthropology, comparative politics, consumer economics and housing, demography-ecology, design, econometrics and economic statistics, economic development and planning, economic and social statistics, economic theory, environmental analysis, environmental engineering, experimental psychology, general psychology, history of architecture, law, natural resources conservation, organization behavior and social action, operations research, personality and social psychology, political thought, public administration, public policy, research methodology, social anthropology, sociology of development, sanitary engineering, and transportation engineering among others.

It is recommended that students take a qualifying examination early in their program in addition to the examinations required by the Graduate School.

Information not found in this *Announcement* may be obtained by writing to the Graduate Faculty Representative, City and Regional Planning, West Sibley Hall.

Master of Regional Planning

Graduate study for the Master of Regional Planning

degree is administered by the College of Architecture, Art, and Planning under the jurisdiction of the Graduate School operating through the department. The standard requirement of the Graduate School for the selection of major and minor subjects does not apply to planning students at the master's level. Instead, prospective students are subject to the specific requirements of the department. Course offerings are provided by the Department of City and Regional Planning, which offers three formal specializations: regional development planning, social policy planning, and urban development planning. Though students may select one of these specializations during the first year of study, there is great flexibility for the design of individual programs of study. The program leading to the M.R.P. degree normally requires four residence units. Further information is listed in the *Announcement of the College of Architecture, Art, and Planning.*

Master of Professional Studies (International Development)

In conjunction with the Field of International Development the Department of City and Regional Planning also offers the M.P.S.(I.D.), a one-year program either for experienced professional planners with specific training needs, or for other mid-level professionals with needs for short-term training in planning. The program is described in the department's brochure on *International Studies in Regional Planning.*

Research and Study Opportunities

Faculty and students in the field have engaged in a variety of specialized training programs and research projects. These change from year to year, but recent examples of the former include a work-study training program and a local government assistance program as well as other opportunities for fieldwork experience. Research projects have included a study of the effects of natural disasters, a comparative analysis of development policies for lagging regions in the United States and abroad, a history of urban development and planning in the American southeast, an econometric model of the New York State economy, a study of the impact of industrial locations on regional economics, and studies of technology assessment and science policy. Research is carried out within the department as well as within such specialized units as the Program in Urban and Regional Studies, the Center for International Studies, and the Center for Environmental Research.

Faculty and Specializations

P. Brandford: environmental health planning, epidemiology, quantitative methods, health systems planning and analysis
P. Clavel: planning theory, administration, regional development
S. Clemhout: environmental planning, public policy, quantitative analysis
S. Czamanski: economic analysis for planning including urban growth models, regional social accounts, regional applications of input-output analysis, location theory, housing economics, urban land economics
A. T. Dotson: comparative planning, planning and administrative theory, politics of planning, planning and urbanization in developing countries
N. L. Gilgosch: sociology of the community, mental health planning, social services planning
W. W. Goldsmith: regional development planning and administration, economic analysis, urban and regional planning in developing countries
B. G. Jones: urban and regional quantitative analysis, urbanization theory, planning theory, environmental health planning, historic preservation planning
D. B. Lewis: urban and regional planning in developing countries, technology transfer
D. W. Nelkin: impact of science and technology on urban society, environmental policy development
K. C. Parsons: comprehensive land-use planning, new community planning, university planning
J. W. Reps: land-use regulation, planning administration, comparative planning, history of city planning in the United States
S. Saltzman: quantitative methods and systems analysis in planning, computer applications and information processing systems
R. Schramm: urban fiscal analysis, local governmental financial decision making and planning
S. W. Stein: planning and urban design within the context of comprehensive planning, housing and renewal, preservation of historic districts, enhancement of the visual assets of the city, land-use planning, urban planning practice
I. R. Stewart: urban housing, renewal and development policies and programs, urban politics, new town and suburban development policies and programs, American urban history

Faculty for the M.R.P. Degree Only

R. S. Booth: land-use law, regional land-use planning, environmental law, critical area preservation
V. W. Boyar: local government management and finance, water quality management planning, economic development
K. Grey: urban design, site planning, land-use planning

Civil and Environmental Engineering

Graduate Faculty Representative: William McGuire, 321 Hollister Hall

Major and Minor Subjects: Aerial Photographic Studies and Remote Sensing, Environmental Systems Engineering, Geodetic and Photogrammetric Engineering, Geotechnical Engineering, Hydraulics and Hydrology, Sanitary Engineering, Structural Engineering, Structural Mechanics (minor only), Transportation Engineering, Water Resource Systems (Ph.D. only)

For either an M.S. or Ph.D. program, a minor subject may be selected from the above list of civil and environmental engineering majors with the single exception of water resource systems.

Each student in the Ph.D. program must take a qualifying examination shortly after receiving the M.S., or, if a student comes to Cornell with an M.S., within nine months after arrival. A reading knowledge of one foreign language, usually French, German, or Russian,

may be required of Ph.D. candidates; this requirement is left to the discretion of each student's Special Committee.

Additional information is available by writing to the graduate faculty representative, School of Civil and Environmental Engineering.

The School of Civil and Environmental Engineering also offers the professional degree of Master of Engineering (Civil), which is intended primarily for persons who plan to practice engineering directly. The professional degree requires a minimum of thirty credit hours of graduate-level work in the principles and practices of the field. Specific exit requirements are set for the Master of Engineering (Civil) which include a broad base technical background in the field, courses in design, and professional practice. Students may concentrate in one of the areas within civil and environmental engineering. Additional information may be obtained by writing to the graduate professional engineering programs representative, Hollister Hall.

Research Opportunities

Study and research is usually carried on in one of the major subject areas listed below:

Aerial Photographic Studies and Remote Sensing The techniques of interpretation of aerial photographs and other remote sensing images, coupled with ground observations, are used to establish the overall environment and to define the nature of the problems and aid in their solutions.

Environmental Systems Engineering This area involves the application of systems engineering, economic and political theory, and environmental law to public sector problems including environmental quality management, public health services, and other urban and regional planning problems.

Geodetic and Photogrammetric Engineering Research emphasis is on the development of photogrammetric methods for measuring the shape of large surfaces, such as that of the Arecibo Radio Astronomy Telescope, as well as of small surfaces, such as that of the interior of the human eye. The development of methodology for the measurement of earth movements is also being studied. Research is continuing in analytic aerotriangulation.

Geotechnical Engineering This area is concerned with the study of the engineering properties and use of earth materials and with the measurement of the earth and its component parts. It includes soil and rock mechanics and foundation engineering.

Hydraulics and Hydrology This subject involves the study of fluid mechanics of the environment and the associated application to hydraulics, hydrology, oceanography, and meteorology as related to the wet earth and the atmosphere.

Sanitary Engineering Sanitary (environmental quality) engineering is concerned with the protection and management of the quality of the air-land-water environment for the benefit of society. Degree programs emphasize biological, chemical, and physical phenomena and engineering principles, laboratory and computational skills, and their application to the analysis of relevant problems.

Structural Engineering In addition to the conventional aspects of structural analysis and design, interest in this department includes such relatively new topics as computer-aided analysis methods, design of nuclear reactor containment structures, small-scale models, shells, earthquake engineering, optimization, behavior of thin-steel structures, structural safety analysis using probability theory, and structural materials. Emphasis is placed on the common fundamental background, theoretical and experimental, of all structural engineering.

A brochure on structural engineering at Cornell University is available from the School of Civil and Environmental Engineering, Hollister Hall.

Transportation Engineering and Planning The major emphasis is in the application of analytical techniques to the handling of transportation problems. The approach is typically multimodal and emphasis is given to problems of urban transportation. Specific interests of faculty members lie in the areas of demand modeling for passenger and freight movements, the development of mass transit systems, airport planning and operation, traffic flow theory, transportation systems analysis, and highway design.

Water Resource Systems This area involves the development and application of mathematical and computer-modeling techniques for defining and evaluating alternative design and/or management policies for water and wastewater treatment facilities, multipurpose reservoir systems, regional water quality control, power plant siting and capacity, water pricing, and other institutional and structural measures for controlling and utilizing water resources.

Faculty and Specializations

J. F. Abel: structures
J. J. Bisogni: sanitary engineering
W. Brutsaert: hydrology
F. J. Cesario: transportation
R. I. Dick: sanitary engineering
L. B. Dworsky: water resources; pollution control
G. P. Fisher: environmental systems
R. H. Gallagher: structures
C. D. Gates: environmental quality engineering
P. Gergely: structures
J. M. Gossett: sanitary engineering
D. P. Greenberg: structures
D. A. Haith: water resource systems
A. R. Ingraffea: structures
G. H. Jirka: environmental hydraulics
F. H. Kulhawy: geotechnical engineering
T. Liang: aerial photographs; physical environment
J. A. Liggett: hydraulics
P. L.-F. Liu: hydraulics
R. C. Loehr: agricultural wastes
D. P. Loucks: water resource and environmental systems
W. R. Lynn: environmental systems

G. B. Lyon: surveying
W. McGuire: structures
A. J. McNair: geodesy-photogrammetry
A. H. Meyburg: urban transportation planning and engineering
P. J. Murphy: hydraulics
A. H. Nilson: structures
N. Orloff: technology assessment
T. Pekoz: structural engineering; experimental research
D. A. Sangrey: soil mechanics
R. E. Schuler: economics
C. A. Shoemaker: applied mathematics
F. O. Slate: engineering materials
J. R. Stedinger: systems analysis
R. N. White: structures

Classics

Graduate Faculty Representative: John Coleman, 25 Goldwin Smith Hall

Major and Minor Subject: Classics (ancient history, ancient philosophy, Classical archaeology, Classical rhetoric in the original or translation, Greek language and literature, Indo-European linguistics, Latin language and literature, medieval and Renaissance Latin literature)

Applications must include scores from the Graduate Record Examinations.

Candidates for the M.A. degree ordinarily spend two semesters attending seminars and/or studying with faculty guidance, present a special essay of about thirty pages, and pass a written test in translation from Greek and Latin authors and a general oral examination. They must also demonstrate proficiency in French or German. The final oral examination, based partly on the Classical authors and partly on the special essay, may also serve as the qualifying examination for the Ph.D. degree.

In addition to seminars and other course work, the Ph.D. candidate is responsible for obtaining extensive knowledge of Greek and Latin authors on the official reading lists compiled by the field. Proficiency in a second modern language must also be demonstrated. Every candidate is expected to teach for two semesters.

The requirements for students majoring in Classical archaeology differ from those outlined above in that readings and examinations in archaeology are substituted for some of those in Latin and Greek. Details are available upon request. There are also opportunities to participate in excavations during the summer; Cornell is currently sponsoring an excavation, under the direction of J. E. Coleman, at the Bronze Age site of Alambra in Cyprus.

The Departments of Classics and of Philosophy cooperate in offering a program leading to a Ph.D. in the Field of Classics with ancient philosophy as the major subject. The course of study includes two courses in Plato and in the pre-Socratics (one in the Department of Classics, one in the Department of Philosophy), two courses in Aristotle and/or the Hellenistic philosophers (similarly divided), and such other courses in the Departments of Classics and Philosophy as student and adviser decide.

Among awards available to incoming students are the Florence May Smith Fellowships with a stipend of $2,000 plus tuition.

Cornell Studies in Classical Philology

Since 1887, thirty-eight volumes have appeared in the series. The volumes include grammatical, historical, and archaeological studies, and studies in Classical literature and thought. The series continues to be published.

Faculty and Specializations

F. M. Ahl: Roman epic and tragedy
E. Asmis: Greek and Roman philosophy
A. Betensky: Augustan poetry
K. M. Clinton: Greek epigraphy, Greek and Roman religion, Greek literature
J. E. Coleman: Classical archaeology
J. R. Ginsburg: Greek and Roman history
W. R. Johnson: Roman literature
G. M. Kirkwood: Greek and Roman theatre, Greek lyric poetry
D. L. Malone: Greek and Roman rhetoric, Roman law
G. M. Messing: Classical and Indo-European linguistics
P. Pucci: textual criticism, Greek theatre

Communication Arts

Graduate Faculty Representative: Robert H. Crawford, 640 Stewart Avenue

Major and Minor Subject: Communication Arts

The field offers graduate training leading to the degree of Master of Professional Studies (Communication Arts). Candidates for the master's or Ph.D. degrees in other fields may minor in communication arts.

The program emphasizes: (1) analysis of the communication process, (2) exploration of the potential of communication techniques and technology, and (3) application of these elements to specific communication problems. Focus of the program is on the strategic application of communication knowledge and technology (both mass media and interpersonal) to specific problems in society, rather than on technical competence in media operation.

For applicants whose academic records are outdated or not pertinent to the profession, evidence of superior performance in the professional field will be considered in combination with other evidence.

All applicants are expected to have some competence in one or several areas of communication or to be willing to spend time beyond the normal degree requirements to gain this competence.

The faculty in this field holds research interests in the following areas: press, telecommunications, international communication, communication theory, interpersonal communication, visual communication, history of the mass media, advertising, population affairs communication, and sociopolitical dimensions of the mass media.

Faculty

N. E. Awa, J. A. Barwind, R. D. Colle, R. H. Crawford,

C. H. Freeman, J. E. Lawrence, R. D. Martin, C. C. Russell, V. R. Stephen, W. B. Ward, S. A. White

Comparative Literature

Graduate Faculty Representative: Bertel Pederson, 227 Goldwin Smith Hall

Major and Minor Subject: Comparative Literature

Applicants should be prepared to study three literatures (one of which may be English or American) in the original language. The field requires scores of the Graduate Record Examinations Aptitude and Advanced Tests.

Normally all candidates are admitted directly to the Ph.D. program; however, a candidate may be granted an M.A. after the admission to candidacy examination or may take a master's degree in a chosen literature.

Specialization is possible in almost every major area from medieval to modern studies and in literary criticism and theory. Students can spend some time in Europe and receive full graduate credit.

A qualifying examination is given during the first semester. The student's course of study is very flexible and is adapted to individual needs. In principle, the candidate may choose between two typical patterns of study, though combinations of the patterns are of course possible.

In Pattern I, the principal concentration is in one national literature with minors in two others. English and American cannot be counted as separate literatures for this purpose. In the major, topics are drawn from the whole history of that literature; in the two minors, for a restricted historical period.

In Pattern II, the student is still responsible for three literatures, but the three areas of concentration will be (1) a period or literary movement; (2) a genre, or an aspect of theory; and (3) at least one major writer.

Faculty and Specializations

M. H. Abrams (English), E. A. Blackall (German), M. Carlson (theatre arts), C. M. Carmichael (comparative literature and biblical studies), J. Culler (English and comparative literature), E. G. Fogel (English), G. Gibian (Russian), A. Grossvogel (French and Italian), D. I. Grossvogel (French and comparative literature), P. U. Hohendahl (German and comparative literature), W. W. Holdheim (French and comparative literature), R. E. Kaske (English), W. J. Kennedy (comparative literature), G. M. Kirkwood (Classics), C. Morón-Arroyo (Spanish), E. P. Morris (French), B. Pedersen (comparative literature), E. Rosenberg (English and comparative literature)

Computer Science

Graduate Faculty Representative: Robert L. Constable, 432 Upson Hall

Major and Minor Subjects: Computer Science, Information Processing, Numerical Analysis, Theory of Computation

Applicants are expected to have had significant experience in programming a digital computer and appropriate background in the particular major subject chosen to permit immediate enrollment in graduate-level courses.

A candidate for the degree of Ph.D. must demonstrate reading ability in one language besides English: French, German, Russian, or any language in which there exists a substantial body of literature in the area of the student's doctoral thesis.

The field is concerned with fundamental knowledge in automata, computability, and programming languages and systems programming, as well as with subjects such as numerical analysis and information processing, which underlie broad areas of computer applications. Graduate students should consider majoring in computer science if they are primarily interested in the general aspects of computational processes, both theoretical and practical, e.g., theory of algorithms, methods by which algorithms are implemented on a computer, and information structures.

Computing Facilities

The principal computing facility at Cornell is an IBM 370/168 located in Langmuir Laboratory on the periphery of the campus and directly linked to satellite computers at three campus locations. The College of Engineering and the Department of Computer Science are served through a satellite station in Upson Hall and by a number of teletypewriter terminals. The department also has a PDP 11/60 system which is used exclusively for research and graduate instruction in computer science.

A booklet describing graduate work in computer science may be obtained by writing to the graduate faculty representative.

Faculty and Specializations

Numerical analysis: J. H. Bramble, J. E. Dennis, S. P. Han, C. Van Loan
Programming languages and systems: G. Andrews, R. Cartwright, R. W. Conway, A. Demers, J. Donahue, D. Gries, W. L. Maxwell, R. Teitelbaum, J. H. Williams
Theory of computation and algorithms: R. L. Constable, J. Hartmanis, J. E. Hopcroft, A. Nerode
Information organization and retrieval: G. Salton
Systems and control theory: C. Pottle
Adaptive systems: H. D. Block

Consumer Economics and Housing

Graduate Faculty Representative: Alice J. Davey, 107 Martha Van Rensselaer Hall

Major and Minor Subjects: Consumer Economics, Housing

All candidates resident in the United States during the year preceding matriculation at Cornell must submit scores of the Graduate Record Examinations Aptitude Test with their applications. All doctoral applicants must have a master's degree before they are accepted.

Consumer economics is concerned with the welfare of the consumer in the private, semipublic, and public

sectors of the economy, particularly as these operate to affect the real level of living of families. Graduate work in this major is built on a base of economic theory and statistics, with an adequate foundation in mathematics. Specific areas of specialization include economics of the household, consumers and the market, family management, and consumer policy.

Housing provides an interdisciplinary approach to the subject of housing. Interest in housing is defined in terms of its economic, sociological, and institutional components. Although not required for admission, a basic background in economics and sociology is necessary for the successful completion of the program. Among the possible areas of specialization are the economics of housing, the sociology of housing, and housing policy.

Faculty and Specializations

L. L. Bower: economics of housing
W. K. Bryant: economics of the household, consumers and the market, consumer policy and economics of housing
P. S. K. Chi: sociology of housing, housing policy
S. Clemhout: economics of the household, consumer policy, economics of housing, housing policy
A. J. Davey: family management
M. S. Galenson: consumers and the market, consumer policy
J. Gerner: economics of the household, consumers and the market, consumer policy, economics of housing, housing policy
A. J. Hahn: consumer policy, housing policy
E. S. Maynes: economics of the household, consumers and the market, consumer policy
C. B. Meeks: economics of the household, consumers and the market, family management, consumer policy, sociology of housing, economics of housing, housing policy
J. Robinson: family management
N. C. Saltford: consumers and the market, consumer policy
K. E. Walker: economics of the household, family management
E. Wiegand: economics of the household, consumers and the market, family management, consumer policy

Design and Environmental Analysis

Graduate Faculty Representative: Nancy C. Saltford, 284A, Martha Van Rensselaer Hall

Major and Minor Subjects: Design, Environmental Analysis

The field offers graduate study leading to the M.A., M.S., or M.P.S. (Human Ecology) degree. Candidates for the Ph.D. degree in other fields may minor in this field.

Within the Field of Design and Environmental Analysis, one may study consumer products, interior spaces, and the interaction of individuals with these products and spaces. The multidisciplinary nature of the field permits students with diverse backgrounds to study clothing, textiles, housing, household appliances, home furnishings, and interior spaces. The latter may include family dwellings or institutional living arrangements such as homes for retired persons and occupational settings.

Students majoring in either design or environmental analysis ordinarily develop strength in a discipline base of design and the arts, physical sciences, or behavioral sciences and then coordinate it with knowledge from other disciplines to solve problems pertinent to their area.

Admission to graduate work is based primarily on evidence of the student's capability for advanced study. In addition to credentials required by the Graduate School, candidates desiring a major in environmental analysis (human-environment relations, textiles, consumer products) should submit aptitude (verbal and quantitative) test scores on the Graduate Record Examinations (GRE). Applicants for a major in design with emphasis on historical or cultural aspects must submit scores from either the GRE or the Miller Analogies Test (MAT). A portfolio of visual materials or slides is required of other design majors; it should be sent to the graduate faculty representative. To be considered for certain scholarships and fellowships, all applicants must submit results from one of the above tests.

About two-thirds of the graduate students in the field hold teaching or research assistantships. General fellowships are available to students as well as one restricted to a student specializing in textiles and clothing.

Research and Study Opportunities

The field has well-equipped studios and workrooms, household equipment laboratories, an extensive costume collection, an art and environmental design gallery, and textile laboratories including a temperature and humidity controlled room and modern instruments for chemical and physical analysis.

Faculty and Specializations

Human-Environment Relations
F. D. Becker: environmental psychology, housing, environmental imagery, research methods
E. R. Ostrander: programming and postconstruction evaluation, interdisciplinary collaboration, gerontological applications of environmental research
R. E. Steidl: functional design criteria, livability of dwellings, person-activity-environment relationships

Design
A. Bushnell: interior space planning, consumer product design
J. Carreiro: housing design, product design, design education
G. C. Millican: architectural design, design history, interior design
C. Straight: visual design
S. M. Watkins: functional apparel design

Textiles
D. R. Buchanan: fundamental combustion processes in textiles, fiber structure and property relationships, crystallization in polymers, properties of textile structures

B. A. Lewis: textile chemistry, chemical modification of polymers for improved textile properties, polymer structure-property relationships, biomedical applications
E. Peters: textile flammability, test method development, wear testing, comfort, consumer product safety, nonwovens
N. C. Saltford: textile legislation and marketing, consumer product safety, clothing consumption practices
V. White: science and technology of consumer textiles, textiles for apparel and interiors, mandatory and voluntary standards for consumer textile products

Consumer Products
M. E. Purchase: household equipment, laundry and cleaning systems, consumer product standards

Development Sociology

Graduate Faculty Representative: Milton L. Barnett, 34 Warren Hall

Major and Minor Subjects: Organization Behavior and Social Action, Rural Sociology, Sociology of Development, Methods of Social Research (minor only for Ph.D.).

The field offers training leading to the Master of Science and Doctor of Philosophy degrees, with emphasis on rural societies, on rural social systems and social organization, and on the community and regional development of nations. The program offers preparation for research, for the application of sociology in public service work, for rural development work in the United States and other nations, and for college teaching.

Graduate Record Examinations scores are requested of United States and Canadian applicants and are essential for fellowship applicants. Completion of the master's degree at an institution of recognized standing is prerequisite to acceptance in the Ph.D. program. Admission for students from outside the United States is contingent upon evidence of adequate financial support; first-year foreign students are not usually awarded a fellowship or assistantship.

Typically, a Ph.D. candidate must demonstrate proficiency in at least one of the foreign languages used for scholarly purposes or in a language appropriate to the special area of interest, such as Latin America, South Asia, or Southeast Asia. Students entering the Ph.D. program must take a diagnostic examination given in conjunction with the master's final examination for those who complete the master's degree at Cornell, and otherwise taken during the first term after entry in the Ph.D. program. Ph.D. candidates are generally expected to have directed teaching experience.

A thesis is required for the M.S. degree.

Assistantships provide part-time employment in teaching, research, or public service. The field may recommend candidates for the Liberty Hyde Bailey research assistantships in the agricultural sciences awarded to students in a Ph.D. program. Thesis research is often conducted as a part of assistantship duties in connection with research supervised by the faculty.

Research and Study Opportunities

Some field members draw upon the resources of the Cornell University Agricultural Experiment Station for their research. Recent activities under this sponsorship include studies of the community and its organization, comparative modernization and international rural development, decision making in farm families, development of American rural society, social organization of agriculture, multicounty and regional development, rural manpower and farm labor, rural resource development, community structure and the aged, technological change in agriculture, rural poverty, nonfarm rural land, water resource public decision making, and agricultural and other voluntary associations. For some research areas, graduate assistants who have or are willing to acquire a background in basic agricultural and biological disciplines are sought. Research is being conducted by field members in numerous countries including Brazil, Ethiopia, Indonesia, Italy, Laos, Malaysia, Mexico, The Netherlands, Pakistan, Peru, and the Philippines. There are also several research activities using as units of analysis nations and their administrative subdivisions (states, provinces, counties, districts).

Members of the field participate in the Cooperative Extension Service and the International Agricultural Development programs of the New York State College of Agriculture and Life Sciences, in the Center for International Studies, and in the area programs for Latin America, South Asia, and Southeast Asia. Several of these programs have supported dissertation research overseas.

A data bank initiated in the Department of Rural Sociology provides data on domestic units (New York State and the Northeast Region). A Comparative Modernization Research Methods Project is sponsored jointly by the Center for International Studies and the Department of Rural Sociology. The Regional History Collection of Olin Library is acquiring an extensive set of material especially useful for the study of rural social movements and farm organizations in the United States.

Requirements for Major Subjects

Organization Behavior and Social Action For the Ph.D., a student is expected to demonstrate: (1) a thorough knowledge of theories of organization behavior, of decision making and social action, of leadership strategies, and of techniques of planned change at the organizational, community, and regional levels, with special emphasis on the rural sector of society; (2) a working knowledge of evaluation and research methods; and (3) a working knowledge of theories of social organization and social change. For the M.S. degree, a general knowledge of part (1) and part (2) is required.

Rural Sociology For the Ph.D., a student is expected to demonstrate: (1) a thorough knowledge of the sociology of rural social systems and of research in this area; (2) a working knowledge of research meth-

ods; and (3) a working knowledge of theories of social organization and social change. For the M.S. degree, a general knowledge of part (1) and of (2) or (3) is required.

Sociology of Development When this subject is offered as a major for the Ph.D., the student is expected to demonstrate: (1) a thorough knowledge of theories of social organization and change and an understanding of the application of these theories to planned change; (2) a knowledge of research in social organization and change, with emphasis on comparative studies of societies and their subsystems in different phases of modernization; and (3) a working knowledge of research methods. For the M.S. degree, a student is expected to demonstrate a general knowledge of part (1) and of (2) or (3).

Faculty

M. L. Barnett, W. W. Bauder, H. R. Capener, P. Clavel, J. M. Cohen, E. W. Coward, Jr., G. J. Cummings, P. R. Eberts, E. C. Erickson, J. D. Francis, M. K. Miller, J. C. Preston, W. F. Whyte, L. K. Williams, R. M. Williams, Jr., F. W. Young

East Asian Literature

Graduate Faculty Representative: Tsu-Lin Mei, 154 Rockefeller Hall

Major Subject: East Asian Literature

Minor Subjects: Chinese Literature, Chinese Linguistics, Japanese Literature, Japanese Linguistics

At least two years of Chinese or Japanese language study are required for admission, and prior work in English or European literature is desirable. Candidates for the Ph.D. degree whose undergraduate education has been in a Chinese or Japanese university are normally expected to have taken a degree in English or European literature before admission.

Students may concentrate exclusively in either Japanese or Chinese, or they may do work in both areas. Minor subjects may also be chosen from other fields in the University, such as other literatures, comparative literature, linguistics, and theatre arts. Individual programs are designed in consultation with the Special Committee chairperson.

Candidates for the M.A. degree are expected to take five semester courses and write a thesis. A reading knowledge of Japanese is essential for the M.A. degree in Chinese, and candidates in Japanese must study either Chinese or *Kambun*.

A Ph.D. qualifying examination is given during the second semester of the first year. For the Ph.D. degree, a reading knowledge of a second East Asian language is normally required and reading knowledge of at least one European language is highly desirable. Candidates for the Ph.D. degree are eligible for fellowships offered under the China-Japan Program.

Faculty and Specializations

N. C. Bodman: Chinese linguistics
K. Brazell: Japanese literature
B. deBary: Japanese literature
E. Jorden: Japanese linguistics
J. McCoy: Chinese and Japanese linguistics, Chinese literature
T.-L. Mei: Chinese literature and philosophy

Ecology and Evolutionary Biology

Graduate Faculty Representative: Peter F. Brussard, 239 Langmuir Laboratory

Major and Minor Subjects: Ecology (aquatic ecology, community and ecosystem ecology, environmental physiology, general ecology, limnology, oceanography, parasitology, population ecology, terrestrial ecology); Evolutionary Biology (environmental physiology, ichthyology, parasitology, population biology, vertebrate zoology)

Applicants are required to present scores of the Graduate Record Examinations Aptitude and Advanced Biology Tests.

The language requirement for the Ph.D. degree is proficiency in two languages or superior ability in one. One language is required for the master's degree. A written field examination in the subject matter of ecology and evolutionary biology is normally taken by Ph.D. candidates during the second semester. In any event, it must be taken before the student can schedule an admission to candidacy examination.

Students obtain teaching experience as teaching assistants for two terms in one of several basic or advanced courses. This requirement may be waived for students who come to Cornell with teaching experience.

Faculty and Specializations

Members of the faculty will be especially interested in directing research in the areas mentioned below, although research will not be limited to these areas. Prospective students will find it to their advantage to correspond with staff members whose interests are most closely related to their own before they apply.

K. Adler: photoreception, orientation, navigation and circadian rhythms of vertebrates
M. Alexander: microbial ecology
J. P. Barlow: biological oceanography; plankton ecology
C. O. Berg: bionomics of freshwater invertebrates
E. B. Brothers: ichthyology
W. L. Brown: systematics of ants; evolutionary theory
P. F. Brussard: structure and genetics of natural populations; species diversity
R. E. Buskirk: social behavior, field studies
T. J. Cade: environmental biology of vertebrates
B. F. Chabot: plant ecophysiology
J. L. Cisne: arthropod biology and paleobiology; marine ecology and paleoecology
L. C. Cole: population ecology
W. C. Dilger: vertebrate ethology
G. C. Eickwort: systematics; behavior and evolution of wild bees and mites; pollination ecology
T. Eisner: behavior of insects; chemical basis of behavior; biocommunication
S. T. Emlen: behavioral ecology; evolution of behavior

H. E. Evans: developmental and gross anatomy, teratology (fish to mammal)
P. P. Feeny: chemical ecology of insect-plant relationships
G. G. Gyrisco: population dynamics; insect flight; diapause; pesticide residues; insect sound
C. A. Hall: (aquatic) ecosystems; modeling
R. G. Helgesen: quantitative population ecology of insects
H. C. Howland: mathematical biology; systems analysis
J. W. Hudson: physiological ecology of mammals
W. T. Keeton: ecology, evolution, and behavior of birds and noninsect arthropods
J. M. Kingsbury: phycology
J. P. Kramer: ecology and biology of entomopathogenic microbes, especially protozoans
S. A. Levin: population biology; mathematical biology; applied mathematics
G. E. Likens: limnology; aquatic ecology; analysis of ecosystems
W. N. McFarland: comparative and environmental physiology of vertebrates
P. L. Marks: plant ecology
A. N. Moen: wildlife ecology; environmental stress on physiology and ecology of mammals and birds
R. T. Oglesby: ecosystems, with particular emphasis on enrichment and population problems
L. L. Pechuman: taxonomy; evolution, distribution and ecology of Diptera, especially Tabanidae and related families
D. Pimentel: population ecology; ecosystems
F. H. Pough: environmental physiology, especially of lower vertebrates; herpetology
M. E. Richmond: vertebrate ecology and reproduction
R. B. Root: comparative ecology and the organization of terrestrial communities
C. A. Shoemaker: applications of mathematics and operations research to problems in ecosystems management
E. L. Stone: forest soils, nutrition, and nutrient cycles in natural vegetation
M. J. Tauber: reproductive behavior; photoperiodism and biological control
D. A. Webster: population dynamics of fishes
M. Whalen: variation, evolution, distribution, and classification of flowering plants
J. H. Whitlock: experimental epidemiology and endemiology
R. H. Whittaker: plant communities
W. D. Youngs: fishery biology

Economics

Graduate Faculty Representative: Peter D. McClelland, 434 Uris Hall

Major and Minor Subjects: Econometrics and Economic Statistics, Economic Development and Planning, Economic History, Economics of Participation and Labor-Managed Systems, Economic Theory, History of Economic Thought, Industrial Organization and Control, International Economics, Labor Economics, Monetary and Financial Economics, Public Finance and Fiscal Policy.

In addition to their major and two minors, doctoral candidates are expected to be familiar with the methods of quantitative analysis and the fundamentals of economic theory.

Students should consult the descriptions of the Fields of Agricultural Economics, Business and Public Administration, City and Regional Planning, and Industrial and Labor Relations for other related subjects. Attention is also directed to the various international studies programs discussed on pp. 16-20.

All applicants must take the Graduate Record Examinations Aptitude Test; the GRE Advanced Test in Economics is also recommended.

Since some mathematics is used in graduate courses and current economics literature, every applicant should have preparation at least through introductory calculus. Exceptional candidates who lack such preparation may be admitted, but they will find their first year of graduate study seriously disrupted by the need to remedy this deficiency.

Applications for teaching assistantships should be made directly to the graduate faculty representative of the Department of Economics.

Faculty and Specializations

Econometrics and economic statistics: W. Brock, R. Ehrenberg, R. H. Frank, W. H. Greene, M. Majumdar, S. T. Marston, R. E. Schuler, E. Thorbecke
Economic development and planning: M. G. Clark, T. E. Davis, R. T. Freeman, F. H. Golay, M. Haines, J. W. Mellor, G. J. Staller, E. Thorbecke, J. Vanek, H. Y. Wan, Jr.
Economic history: T. E. Davis, M. Haines, P. D. McClelland
Economics of participation and labor-managed systems: T. E. Davis, G. J. Staller, J. Vanek
Economic theory: W. Brock, L. Ebrill, R. Ehrenberg, R. H. Frank, M. Gertler, E. Grinols, G. H. Hildebrand, M. Majumdar, R. Masson, U. Possen, R. E. Schuler, S. Slutsky, S. C. Tsiang, J. Vanek, H. Y. Wan, Jr.
History of economic thought: G. H. Hildebrand
Industrial organization and control: W. H. Greene, A. E. Kahn, R. Masson
International economics: T. E. Davis, L. Ebrill, R. T. Freeman, F. H. Golay, E. Grinols, G. J. Staller, E. Thorbecke, S. C. Tsiang, J. Vanek, H. Y. Wan, Jr.
Labor economics: R. Ehrenberg, W. Galenson, G. H. Hildebrand
Monetary and financial economics: T. E. Davis, R. T. Freeman, E. Grinols, S. Marston, U. Possen, S. Slutsky, S. C. Tsiang
Public finance and fiscal policy: R. E. Schuler, S. Slutsky
Regional science: L. Ebrill, M. Gertler, W. Isard

Education

Graduate Faculty Representative: D. B. Gowin, 107 Stone Hall

Major and Minor Subjects: Agricultural and Occupational Education; Curriculum and Instruction; History, Philosophy, and Sociology of Education; Educational Administration; Educational Psychology and Measurement; Educational Research Methodology;

Extension and Continuing Education; Home Economics Education; Science and Environmental Education

The field of education is conceived broadly with a dual concern for primary theoretic knowledge and professional knowledge of choice and action. Scholarly study of educative phenomena is approached through relevant conceptions and principles, selected techniques and methods, and reflective examination of contemporary programs and practices. Areas of practical study include public and private schools, colleges, universities, state and federal agencies, and industrial enterprises, both nationally and internationally.

All applicants whose native language is English are required to submit either a score from the Graduate Record Examinations Aptitude Test or the score of the Miller Analogies Test. The GRE score is necessary for University fellowship applications.

Information on research assistantships, teaching assistantships, and fellowships, as well as application for admission forms may be obtained from the Secretary, Field of Education, 102 Stone Hall. Please note that applications for admission are also applications for financial aid consideration; no additional form is needed.

The Field of Education offers two types of advanced degrees: the general degrees of M.A., M.S., and Ph.D.; and the professional degrees of Master of Arts in Teaching, Master of Professional Studies (Agriculture; Human Ecology), and Doctor of Education (see pp. 13-14).

Facilities

The Institute for Occupational, Adult, and Continuing Education The institute conducts basic and applied research, ranging from career decision making and occupational preparation to adult education. Students participate in the work of the institute through paid fieldwork internships and research assistantships, participation in institute workshops and seminars, and activities associated with thesis projects and course work.

Other departmental facilities include a computer laboratory for the study of reading, portable videotaping technology, a photography laboratory, and the Instructional Materials Service.

Faculty and Specializations

Agricultural and Occupational Education
W. E. Drake, coordinator; J. P. Bail, A. L. Berkey, H. R. Cushman, J. Dunn

This program focuses on preparing students for specialized positions as teacher educators in agriculture and administrators of occupational education enterprises. Candidates are encouraged to take substantial course work in a related field of study that will contribute to professional and technical competence.

Current research includes competency-based teacher education, curriculum development, evolution of instructional materials, improvement of college teaching, and the explication of alternative procedural models for adult education.

Curriculum and Instruction
G. J. Posner, coordinator; W. L. Brittain, W. E. Drake, H. A. Geiselmann, D. B. Gowin, D. Henderson, J. D. Novak, K. Rhodes, R. E. Ripple, V. N. Rockcastle, F. H. Stutz, H. L. Wardeberg

The main focus of this program is on content organization, the structure of knowledge, cognitive structure, and the relationship among these areas of study. Students may focus on the curricula of subject areas such as science, mathematics, art, reading, and occupational education or on general curriculum topics from various disciplinary perspectives such as philosophy, psychology, and sociology.

Current research deals with the design of courses, the improvement of college teaching, the structure of knowledge, the transmission and assessment of knowledge, curriculum development and evaluation in higher education, and the relationship between theories of learning and the curriculum.

Educational Psychology and Measurement
R. E. Ripple, coordinator; H. G. Andrus, M. Glock, J. Harding, D. Hedlund, J. Maas, G. W. McConkie, J. Millman, J. D. Novak, W. Pauk

This program focuses on methods of inquiry in educational psychology, human learning, the psychology of reading, lifelong development, interpersonal and group processes, personal effectiveness, and the helping relationship in both informal and formal educational enterprises.

Educational Research Methodology
J. Millman, coordinator; S. Blackwell, R. L. Bruce, R. B. Darlington, D. Deshler, D. B. Gowin, E. Haller, C. McClintock, H. Y. Nelson, J. D. Novak, G. J. Posner, K. A. Strike

This program focuses on basic concepts in measurement, program evaluation, statistics, and philosophy of science that underlie the design, analysis, and interpretation of investigations about educational phenomena. Training emphasizes acquisition of technical skills, theoretical understanding, and professional experience through fieldwork.

Current research interests include criterion-referenced testing, state and local assessment systems, evaluation models, critical appraisal of research and evaluation studies, theory of value and evaluation, attitude measurement, application of learning theory to measurement problems, and testing by computer.

Extension and Continuing Education
R. L. Bruce, coordinator; N. Awa, J. P. Bail, G. Broadwell, H. Cushman, D. Deshler, D. Hedlund, L. Noble, J. Preston, R. Ripple, H. L. Wardeberg

This program focuses on primary processes of adult learning and development, factors influencing the behavior of adults in the learning process, and designing and managing educational aspects of programs for economic and social change. The program is designed to prepare research scholars and leaders for adult and continuing education pro-

grams in colleges and universities, development organizations, the public schools, and other agencies engaged in the continuing education of adults.

Current research interests include the structure of extension and other continuing education organizations for adults, design of programs, learning and communication processes, and evaluation of programs.

History, Philosophy, and Sociology of Education; Educational Administration
F. H. Stutz, coordinator; J. P. Bail, R. L. Bruce, D. B. Gowin, E. J. Haller, K. A. Strike, H. L. Wardeberg

The philosophy of education program focuses on concept analysis; the logic and language of knowledge and value claims; the clarification of arguments in contemporary educational controversies (e.g., student rights; values education); and the role of educational theories in research and practice. Philosophical distinctions are developed in theoretical contexts (e.g., epistemology) and practical contexts (e.g., curriculum, college teaching, moral education, research practice, and evaluation).

The sociology of education program applies sociological concepts and theories to the study of education. It focuses on the internal dynamics of educational organizations, the links between these processes and the economic and political systems, and on the web of institutions that impinge on educational organizations. Students normally supplement core studies with extensive work in sociology.

Study in governance centers on social science and philosophical concepts and theories as they inform policy development and evaluation.

Current research in these programs deals with studies in the structure of knowledge and value, political philosophy, philosophy of behavioral sciences, political socialization in schools, socioeconomic segregation in schools, the graduate student career, roles of women in colleges and universities, and community decision making in education.

Home Economics Education
H. Y. Nelson, coordinator; S. Blackwell, C. Farris, M. E. Minot, L. A. Noble, K. Rhodes, B. L. Yerka

This program focuses on the analysis of education as an instrument for effective change, with special emphasis on improving the quality of everyday life. Central to the program is study of the nature of change—describing, predicting, effecting, and measuring it. Students interested in becoming teacher educators have an opportunity to enroll in a planned sequence of courses and field experiences culminating in a practicum in which they assume responsibility for a student field experience.

Current research focuses on programs in tenant education; competency-based teacher education; sex role bias; and nutrition for preschool children in rural areas of developing countries.

Science and Environmental Education
R. B. Fischer, coordinator; J. D. Novak, V. N. Rockcastle

This program focuses on (1) science teaching, curriculum development, and research at elementary, secondary, and college levels; (2) environmental education programs leading to professional positions as interpretive naturalists, directors of interpretive nature centers, or conservation education specialists with school systems, state departments, and other private or governmental agencies; (3) environmental education programs oriented toward problems of resource use and social issues; and (4) learning of science concepts.

Current research deals with cognitive learning as related to improvement of science teaching.

Electrical Engineering

Graduate Faculty Representative: Ralph Bolgiano, Jr., 230 Phillips Hall (-7/78); H. S. McGaughan, 402 Phillips Hall (7/78-)

Major and Minor Subjects: Electrical Engineering, Electrical Systems, Electrophysics

Applicants should have had the equivalent of the fundamental work required by an accredited undergraduate curriculum in the area of their major subjects. Applicants are urged to take the Graduate Record Examinations and to have the scores sent to the Cornell Graduate School as part of their application materials.

The M.S. and Ph.D. degree programs require submission of a thesis and are intended for students planning to engage in research as a career. Normally the M.S. is not a terminal degree and students should enter the M.S./Ph.D. program.

Before beginning the second semester of study as a candidate for the Ph.D. degree each student must take a qualifying examination administered by the student's Special Committee.

In addition to University fellowships the following are available: John McMullen Graduate Fellowship, the Schlumberger Foundation Fellowship, the Rockwell International Corporation Fellowships, and the RCA Electronics Research Fellowship.

Professional Degree

The Master of Engineering (Electrical) degree program is open to persons who hold a baccalaureate (or equivalent) degree in engineering or science which is considered appropriate as a background for professional graduate study in the field. The M.Eng. (Electrical) is a thirty-credit hour curricular degree requiring an engineering design project rather than a research thesis. It is intended primarily for persons who plan to practice engineering directly, in industry or professionally. But it may also serve as the first step enroute to the doctorate for individuals who are inclined toward the technological and design aspects of advanced engineering. For further information, contact the graduate faculty representative.

Research Opportunities

Electrical Engineering This area includes electrical measurements; instrumentation; and the conversion, transmission, and control of electrical energy. Some

typical research projects include the design of an electric automobile, a computer-managed system to control the response of an electric power network to faults, and various digital data processing and analysis systems. Other work is closely related to research in the systems or electrophysics areas.

Electrical Systems Research in systems is concentrated in the areas of control theory, information and decision theory, and network analysis and design. Topics studied include stochastic control; optimization and approximation techniques; application of control theory to power systems; the simulation of systems; information coding and transmission; random signal processing; decision making; pattern classification; the analysis, synthesis, and computer-aided design of timevarying, nonlinear, active, and/or distributed parameter networks; digital and switching circuits; computer architecture; and biological systems.

Electrophysics This category includes all research in which the primary concern is the interaction of electromagnetic fields with materials in the solid, liquid, gaseous, or plasma state, including high-energy and geophysical plasmas such as the ionosphere and magnetosphere. Electromagnetic wave propagation and scattering, magnetohydrodynamics, electron beam devices, quantum electronics and lasers, solid state physics, high frequency and optical phenomena in semiconductors, semiconductor devices, and bioelectronics are among the topics studied.

Faculty

P. D. Ankrum, J. M. Ballantyne, T. Berger, H. D. Block, R. Bolgiano, Jr., N. H. Bryant, R. R. Capranica, H. J. Carlin, V. W. Chan, G. C. Dalman, L. F. Eastman, W. H. Erickson, D. T. Farley, T. L. Fine, J. Frey, T. Gold, D. W. Hammerstrom, J. Hartmanis, W. J. Heetderks, M. Kelley, M. Kim, W. H. Ku, C. A. Lee, R. L. Liboff, S. Linke, R. A. McFarlane, H. S. McGaughan, P. R. McIsaac, J. A. Nation, B. Nichols, E. Ott, C. Pottle, E. L. Resler, Jr., J. L. Rosson, R. N. Sudan, C. L. Tang, R. J. Thomas, J. S. Thorp, H. C. Torng, N. M. Vrana, C. B. Wharton, G. J. Wolga

English Language and Literature

Graduate Faculty Representative: Reeve Parker, 252 Goldwin Smith Hall

Major and Minor Subjects: American Literature, American Studies, Creative Writing (cannot be the major for the Ph.D.), Dramatic Literature, English and American Literature, English Poetry, Prose Fiction, Old and Middle English, The English Renaissance to 1660, The Restoration and Eighteenth Century, The Nineteenth Century, The Twentieth Century

Admission

Applicants may request admission to either the Master of Arts program, the Master of Fine Arts program in creative writing, or the doctoral program; however, the Field of English rarely accepts applicants for the terminal Master of Arts degree. Except in unusual circumstances, all applicants are required to submit Graduate Record Examinations scores (Aptitude and Advanced Tests) and should plan to take the examinations by mid-December at the very latest. Applicants for admission to the M.F.A. program must submit samples of their writing to the Committee on the Creative Writing Program, Department of English, Goldwin Smith Hall. The application and all supporting documents and materials must reach the Graduate School by January 15. Because of postal delays and the last-minute rush of transcripts and letters, it will help to guarantee full consideration if applications can be filed earlier.

Approximately sixteen Ph.D. candidates and eight M.F.A. candidates will be enrolled each year. As the ratio of accepted students to applicants is approximately one to twenty, competition is extremely intense and no candidate, regardless of how strong his or her credentials may be, should presume acceptance. The graduate faculty representative will be happy to meet with visiting applicants; such interviews, however, have no bearing upon admission.

Financial Aid

The majority of students accepted for the Ph.D. program will be offered a financial aid package combining nonteaching fellowship and teaching assistantship support. Some M.F.A. candidates will also receive support. A student who has done graduate work elsewhere, or who has had professional teaching experience, may apply for a teaching assistantship for the first year in the program. An applicant who wishes a teaching assistantship should check the appropriate blank of the admission and fellowship application.

The Programs

A candidate for the M.A. should complete at least six one-semester courses for credit, may major either in English and American literature or in creative writing, and must submit a thesis. The thesis of a candidate majoring in creative writing consists of original fiction or poetry.

A candidate for the M.F.A. is expected to complete a workshop course in each of four semesters and a total of eight other courses, of which at least five should be in literature. The thesis is a piece of creative writing (a novel, for example, or a book of poems or short stories).

A candidate for the Ph.D. is normally expected to complete six one-semester courses for credit in the first year of residence, and a total of at least six more in the second and third years. The program of any doctoral candidate's formal and informal study, whatever his or her particular interests, should be comprehensive enough to give some familiarity with (1) the authors and works that have been most influential in determining the course of English and American literature; (2) the theory and criticism of literature; (3) the relations between literature and other disciplines; and (4) such basic scholarly concerns as textual criticism, analytic bibliography, and problems of attribution, authentication, genre, source, and influence. The Ph.D. student chooses a major

and one or two minors. The major is selected from a list of historical, generic subjects such as the English Renaissance to 1660, the nineteenth century, prose fiction. Minors may be selected from the same list, but students are encouraged to choose one or both minors from among the offerings of related fields. A student electing to major in American studies within the field of English will define the major to include a minor in history and will choose a second minor from some non-American subject in the area of concentration.

Within each of these programs, the special committee procedure eliminates uniform course requirements and departmental examinations and serves to provide a close working relationship between professors and students and to encourage freedom and flexibility in the choice of a route toward the graduate degree. The Special Committee directs and judges progress at a series of meetings with the student in which it reviews the course work, the individual work done with members of the committee and with others, and the student's own assessments of his or her progress. Before a doctoral candidate enters the fourth semester of graduate study, the Special Committee must decide whether he or she is qualified to proceed toward the Ph.D.

Doctoral candidates will ordinarily be expected to acquire some teaching experience as part of their professional preparation.

Language Requirement

Foreign language proficiency and the study of the English language are so basic as to be given special emphasis. Each student and Special Committee will decide what work in these areas is most appropriate to the rest of his or her graduate program and scholarly interests.

Some doctoral programs require extensive knowledge of a single foreign language and literature; others require competent reading ability in two or more foreign languages. Programs of study for the M.F.A. normally require reading ability in one foreign language. A student may be asked to demonstrate competence in any of several ways—for example, by presenting the undergraduate record, by taking additional courses in foreign languages and literature, or by translating and discussing documents related to the student's work in English and American literature.

To pursue the study of the English language, a student may be asked to take departmental course offerings in Old English, in the history of the English language, in grammatical analysis, or in the application of linguistic study to the history of English literature, to metrics, or to literary criticism. Several other departments provide courses in such subjects as descriptive linguistics, psycholinguistics, and the philosophy of language.

Staff and Resources

Graduate work at Cornell offers the opportunity for professional study in a distinguished academic community of extensive resources. The Cornell University Library system includes over four million volumes; of special interest to graduate students is the John M. Olin Library, which is among the foremost university libraries in the United States. Its special holdings include Dante and Petrarch collections unique in this country, a splendid and comprehensive Wordsworth collection, the Wyndham Lewis papers, a distinguished Icelandic collection, and one of the great Joyce collections of the world. In recent years its materials have served for major studies of Romantic thought, Joyce, John Stuart Mill, Ford Madox Ford, and other important subjects.

The quality of the work done by graduate students in English is of course largely conditioned by the staff with whom they work and the academic environment which the staff and the students together create. In addition to the distinguished graduate faculty in such related departments as Comparative Literature, Romance Studies, German, History, Philosophy, Theatre Arts, and Classics, the following members of the English faculty are normally available to direct graduate work and to serve on Special Committees:

Old and Middle English: R. T. Farrell, T. D. Hill, R. E. Kaske, W. Wetherbee, III
The Renaissance: B. B. Adams, E. G. Fogel, C. V. Kaske, C. S. Levy, D. Novarr
The Restoration and the Eighteenth Century: S. Budick, D. D. Eddy, S. B. Elledge
The Nineteenth Century: M. H. Abrams, J. P. Bishop, J. Culler, N. Hertz, T. L. Jeffers, D. M. Mermin, R. Parker, S. M. Parrish, P. Sawyer
The Twentieth Century: P. L. Marcus, J. B. Merod, B. Rosecrance, S. Siegel, J. Stallworthy
American Literature*: M. J. Colarcurcio, R. H. Elias, D. E. McCall, J. S. Redding, S. C. Strout
Prose Fiction: J. F. Blackall, E. Rosenberg, D. R. Schwarz, W. J. Slatoff
Dramatic Literature: A. Caputi, H. S. McMillin, B. O. States
Creative Writing: A. R. Ammons, W. L. Herrin, A. Lurie, K. A. McClane, J. R. McConkey, R. Morgan

This list is illustrative rather than exhaustive, since most faculty members are available to direct work in areas other than those cited.

The creative writing staff published *Epoch*, a periodical of contemporary literature.

Entomology

Graduate Faculty Representative: M. J. Tauber, 168A Comstock Hall

Major and Minor Subject: Entomology (acarology, apiculture, aquatic entomology, biological control, economic entomology, general entomology [minor only] insect behavior, insect biochemistry, insect ecology, insect morphology, insect pathology, insect physiology, insect taxonomy, insect toxicology and insecticide chemistry, medical entomology)

Excellent facilities for laboratory and field studies are available that include the outstanding Comstock Entomological Library and a renowned insect collection.

* An information sheet on American studies is available on request to the graduate faculty representative.

The Field of Entomology requires a prescriptive academic review for doctoral candidates, usually held during the first semester of work. A core curriculum is available from the graduate faculty representative. The minimum requirement for the Ph.D. degree is proficiency in one foreign language.

In addition to teaching and research assistantships and the Comstock Scholarship, traineeships are available in several areas.

Faculty and Specializations

C. O. Berg: aquatic entomology; ecology and systematics of snail-killing flies
W. L. Brown, Jr.: systematics and evolution; ants
E. W. Cupp: medical entomology; bionomics of blood-feeding Diptera
J. E. Dewey: economic entomology; pesticide technology; extension
G. C. Eickwort: insect morphology; systematics and behavior of wild bees; acarology
G. G. Gyrisco: economic entomology; ecology of forage crop insects
H. H. Hagedorn: insect physiology
R. G. Helgesen: economic entomology; insect pest management; population ecology
W. T. Johnson: economic entomology; insects on ornamental plants
J. P. Kramer: insect pathology; protozoan and fungal diseases
R. A. Morse: apiculture; honey bee social behavior
A. A. Muka: economic entomology; vegetable and forage crop insects; extension
L. L. Pechuman: tabanid systematics
D. Pimentel: insect ecology; population ecology; genetic feedback
E. M. Raffensperger: economic entomology; household insects
E. T. Schmidtmann: veterinary entomology; ectoparasitic arthropods of livestock
M. Semel: economic entomology; vegetable crop insects
E. H. Smith: department chairperson; economic entomology; fruit insects
M. J. Tauber: biological control; insect behavior
W. M. Tingey: plant resistance to insects; insects on potatoes
C. F. Wilkinson: insect toxicology; synergists and detoxification mechanisms
R. G. Young: insect biochemistry; metabolism of toxicants

Faculty at the New York State Agricultural Experimental Station, Geneva
W. S. Bowers: insect biochemistry and physiology; insect hormones
A. C. Davis: economic entomology; insects on cole crop, sweet corn, and tomatoes
C. J. Eckenrode: economic entomology; soil and vegetable crop insects
E. H. Glass: department head; economic entomology; pome fruit insects
S. E. Lienk; economic entomology; stone fruit insects
W. H. Reissig: economic entomology; insect biology and pest management
W. L. Roelofs: organic chemistry; pheromones: isolation, identification, and synthesis
G. A. Schaefers: economic entomology; ecology of small fruit insects
E. F. Taschenberg: economic entomology; insects in vineyards
H. Tashiro: economic entomology; insects of ornamentals and turf

Members of the field in other departments at Ithaca
T. Eisner: insect behavior; insect-plant interactions
P. P. Feeny: chemical ecology; herbivorous insects
W. T. Keeton: systematics; evolution; behavior
R. B. Root: insect ecology; organization of terrestrial communities
C. A. Shoemaker: systems analysis in pest management

Environmental Quality

Graduate Faculty Representative: R. C. Loehr, 207 Riley-Robb Hall

Minor Subject: Environmental Quality

This minor field offers qualified engineers and scientists an opportunity to broaden their knowledge in physical, chemical, and biological areas related to environmental quality problems and their control. It is intended to encourage interdisciplinary study, and students selecting it will take courses in several disciplines with the objective of understanding the environment and its interaction with man. The field will include the combination of courses, seminars, and projects considered best for the individual student.

A student seeking a master's degree will ordinarily take a minimum of three courses for this minor, with the courses being given in at least two areas outside the maior field; while a student seeking a doctoral degree will ordinarily take a minimum of five courses, given in at least two areas outside the major field.

Faculty

B. E. Dethier, N. C. Dondero, L. B. Dworsky, C. D. Gates, D. A. Haith, L. S. Hamilton, W. J. Jewell, R. C. Loehr, D. P. Loucks, D. C. Ludington, W. R. Lynn, R. T. Oglesby, G. W. Olson, D. Pimentel, H. W. Seeley, Jr., J. C. Thompson, R. R. Zall

Floriculture and Ornamental Horticulture

Graduate Faculty Representative: John G. Seeley, 8 Plant Science Building

Major and Minor Subject: Floriculture and Ornamental Horticulture

Admission to the field is based on the quality and nature of the applicant's prior training as well as on letters of recommendation. Some priority is given to applicants who have done undergraduate work in horticulture. Other applicants must have strong backgrounds in biological and agricultural sciences and strong interests in floriculture and ornamental horticulture.

For the Ph.D. degree, the field requires a qualifying examination taken early in the program, preferably

no later than the second term of residence, in addition to the other examinations required by the Graduate School.

There is no specific foreign language requirement by the field for the M.S. and Ph.D. degrees; however, the Special Committee may recommend or require proficiency in a foreign language for the Ph.D.

For the M.P.S. (Agriculture) degree, the field requires completion of thirty course hours related to the student's professional interests, successful completion of a problem-solving project, and a minimum grade point average of 2.5.

Research Opportunities

Excellent opportunities for graduate study and research are offered in all phases of floriculture and ornamental horticulture. Areas of specialization include greenhouse floriculture crops, nursery crops, turfgrass, ornamental horticulture physiology, taxonomy of ornamental plants, and landscape architecture. Studies relating to the physiology, growth and development, propagation, nutrition, production management, and culture of floriculture and nursery crops and turfgrasses may be undertaken as research for an advanced degree and should be approached from the standpoint of the basic sciences. Consequently, it is appropriate to select minor areas of study from such areas as plant physiology, pathology, biochemistry, botany, entomology, anatomy, morphology, taxonomy, plant ecology, genetics, education, agricultural economics, and agricultural engineering.

Outstanding facilities include laboratories specifically equipped for studies on growth regulators, foliar and soil analysis, radioisotopes, tissue culture, stress physiology, postharvest physiology, and various other physiological and anatomical topics. Controlled environment rooms, greenhouses and outdoor nursery, and turfgrass production areas are also available.

Faculty and Specializations

J. W. Boodley: culture of greenhouse ornamental crops, especially foliar analysis; soils and nutrition

R. T. Fox: retail florist shop management; merchandising, layout, and shop efficiency

G. L. Good: culture of nursery crops, especially nutrition and container production

C. F. Gortzig: floriculture crop production management; floriculture extension programming

J. F. Kaufmann: turfgrass management and physiology; weed control

R. W. Langhans: culture of greenhouse environments and propagation by tissue culture

R. G. Mower: taxonomy of ornamental plants; plant evaluation and selection for landscape characteristics

J. G. Seeley: culture of greenhouse ornamental crops, especially nutrition

P. L. Steponkus: physiology of horticultural crops, especially cold acclimation and freezing injury, high-temperature injury, and senescence; postharvest physiology of cut flowers

H. B. Tukey, Jr.: physiology of horticultural crops, especially uptake and loss of substances by plants; chemical ecology; propagation and growth regulation

Landscape Architecture courses given in the Department of Floriculture and Ornamental Horticulture are taught by M. I. Adleman, R. W. Dwelle, T. Johnson, and P. S. Tresch.

Food Science and Technology

Graduate Faculty Representative: John E. Kinsella, 101 Stocking Hall

Major and Minor Subjects: Food Science, General (majors may not minor within the field); Dairy Science; International Food Science; Food Chemistry; Food Microbiology; Food Processing Waste and Water Technology

Candidates for the M.S. degree are required to register for one major within the field and one minor outside the field. Candidates for the Ph.D. degree are required to register for one major within the field and two minors, at least one of which is taken outside the field. There are no course hour requirements for the M.S. or Ph.D. degrees. In addition to the examinations required by the Graduate School, a qualifying examination is required of Ph.D. candidates before the start of their second semester of residence.

Applicants should have good training in biology, chemistry, microbiology, and biochemistry; prior training in food science is desirable. Applicants must submit scores of the Graduate Record Examinations Aptitude Test. Foreign students are required to take the TOEFL in addition to the GREs.

The field offers excellent opportunities for graduate study in both basic and applied research. All course work is taken on the Ithaca campus, but students may conduct their research at the New York State Agricultural Experiment Station in Geneva as well as on the Ithaca campus.

Faculty and Specializations

Food Science, General
T. E. Acree*, G. D. Armbruster, R. C. Baker, J. B. Bourke*, M. C. Bourne*, M. M. Devine, T. W. Downes, D. L. Downing*, D. C. Graham, L. R. Hackler*, Y. D. Hang, J. R. Hicks, L. F. Hood, W. K. Jordan, J. E. Kinsella, F. V. Kosikowski, R. L. LaBelle*, C. Y. Lee*, F. W. Liu, L. M. Massey, Jr.*, N. Mondy, M. A. Morrison, J. C. Moyer*, H. B. Naylor, N. N. Potter, M. A. Rao*, J. M. Regenstein, W. B. Robinson*, J. W. Sherbon, W. F. Shipe, M. L. Shuler, D. F. Splittstoesser*, K. H. Steinkraus*, G. S. Stoewsand*, J. R. Stouffer, J. P. Van Buren*, J. C. White, R. R. Zall

Dairy Science
L. F. Hood, W. K. Jordan, J. E. Kinsella, F. V. Kosikowski, R. A. Ledford, R. P. March, N. N. Potter, J. W. Sherbon, W. F. Shipe, J. C. White, R. R. Zall

International Food Science
M. C. Bourne*, L. R. Hackler*, L. F. Hood, W. K. Jordan, J. E. Kinsella, F. V. Kosikowski, R. L. LaBelle*,

C. Y. Lee*, W. F. Shipe, K. H. Steinkraus*, J. R. Stouffer

Food Chemistry
T. E. Acree*, G. D. Armbruster, J. B. Bourke*, M. C. Bourne*, L. R. Hackler*, Y. D. Hang, E. E. Hester, L. F. Hood, G. Hrazdina*, J. E. Kinsella, C. Y. Lee*, B. A. Lewis, D. J. Lisk, L. M. Massey, Jr.*, L. R. Mattick*, N. Mondy, M. A. Morrison, M. A. Rao*, J. M. Regenstein, W. B. Robinson*, R. S. Shallenberger*, J. W. Sherbon, W. F. Shipe, G. S. Stoewsand*, J. P. Van Buren*, R. H. Walter*

Food Microbiology
N. C. Dondero, D. C. Graham, J. E. Kinsella, F. V. Kosikowski, R. A. Ledford, H. B. Naylor, N. N. Potter, D. F. Splittstoesser*, J. R. Stamer*, K. H. Steinkraus*, J. C. White

Food Processing Waste and Water Technology
N. C. Dondero, M. L. Shuler, D. F. Splittstoesser*, J. C. White, R. R. Zall

Genetics

(See also the listing under Medical Sciences.)

Graduate Faculty Representative: Peter J. Bruns, 201 Bradfield Hall

Major and Minor Subject: Genetics

Applicants are urged to submit scores of the Graduate Record Examinations Aptitude and Advanced Biology Tests.

Proficiency in at least one foreign language is strongly recommended for doctoral candidates; any particular requirements are established by the student's Special Committee.

Shortly after the formation of the Special Committee, it meets with the student in order to examine the student's past training and research interests and to recommend a course of study.

All students in the field must have some teaching experience during their course of study.

Faculty members in the Field of Genetics have widely different research interests ranging from molecular through cytological, physiological, developmental, and evolutionary genetics. Students should choose professors whose interests coincide with their own.

Faculty

A. Blackler, S. E. Bloom, P. J. Bruns, J. M. Calvo, R. S. Chaleff, G. R. Fink, R. L. Hallberg, R. J. MacIntyre, A. M. Srb, H. T. Stinson, C. H. Uhl, B. Wallace, S. A. Zahler

Geological Sciences

Graduate Faculty Representative: Donald L. Turcotte, 311 Kimball Hall

Major and Minor Subjects: Economic Geology; Engineering Geology; Environmental Geology; Geobiology, Paleontology, and Stratigraphy; Geochemistry, Mineralogy, Petrology; Geomorphology; Geophysics; Geotectonics and Structural Geology; Marine Geology; Physical Geography; Seismology

Minor Subjects Only: Pleistocene Geology; Hydrogeology; Sedimentation; Oceanography

Students with undergraduate majors in subjects such as engineering, physics, chemistry, biology, and mathematics, as well as in geology, are encouraged to apply. Prior study of geology is not a requirement for admission.

The program is designed to give students the opportunity for broad formal training in the basic sciences as well as in the field and to provide extensive practical experience through research in their specialty. Students have a wide variety of options in the selection of programs which will best suit their interests and talents. At least one minor subject outside the field is required.

For the master's degree and for the doctoral degree proficiency must be established in French, German, or Russian before the candidate completes the second residence unit.

At the time of entrance to the field, a general examination covering the candidate's preparatory training may be given by the faculty to assist in planning a program of study.

For the doctoral degree, a qualifying examination is required in addition to the examinations required by the Graduate School. The qualifying examination will determine the candidates' fitness for undertaking advanced studies and will enable the Special Committees to plan a program which will make the students familiar with the requisite knowledge in their chosen areas. It must be taken before the end of the second semester in residence.

There are several graduate teaching assistantships available in the field. Teaching assistants who are doctoral candidates are eligible for special summer awards.

The Eleanor Tatum Long Fellowship may be awarded to a student specializing in structural geology or geomechanics.

The department has several special endowments which may be used to assist graduate students in their research and fieldwork, and some research assistantships are available.

Master of Engineering

A program is offered in conjunction with the College of Engineering; no thesis is required. A major in an engineering subject is combined with a sequence of courses in geological sciences.

Research and Study Opportunities

The department conducts a number of research programs in various parts of the world covering a variety of research topics. The list is ever changing, but includes such diverse items as study of sea-floor spreading and plate tectonics on a global scale,

* Faculty of the New York State Agricultural Experiment Station in Geneva.

observation of current seismic activity in the South Pacific, investigation of igneous rocks in the Aleutians, study of rocks and minerals from the earth's deep interior, measurement of sea level changes and recent crustal movement in the eastern United States, the Southwest Pacific, and elsewhere, seismic reflection profiling of the deep crust and upper mantle, dynamics and mechanics of the lithosphere and asthenosphere, paleontological problems of New York State and elsewhere, engineering geology of selected localities, field geology in Indonesia, and marine studies of areas available to current cruises. Through the resources of the department and the cooperating faculty of other departments, a wide variety of special and advanced equipment is available.

Working agreements with institutions in other parts of the world are maintained by the department to facilitate research projects in those areas or to work on materials especially accessible at those bases.

The Paleontological Research Institution, a private research organization, is near the campus and its facilities are available to the specialized investigator.

The department has a cooperating agreement with the Museum of Northern Arizona at Flagstaff for accommodating research projects and investigators.

The Ithaca region is particularly suited for research in stratigraphy, paleontology, geomorphology, and glacial geology. The nearby Adirondack area is a classic one for studies of igneous and metamorphic petrology, and much of the Appalachian orogenic belt is readily accessible. Geology is seen as a global science by the department, however, and interests are not limited to the immediate vicinity of the Ithaca campus.

Interdisciplinary Studies

The exceptional flexibility of the graduate program at Cornell provides ample opportunity for students of the geological sciences to work in interdisciplinary areas. For example, special arrangements are already available for study of oceanography, marine ecology, water resources, and various branches of applied geological science. Faculty in other departments or divisions offer many interdisciplinary courses such as paleobotany, ecology-systematics, biogeochemistry, limnology, soil genesis, soil mineralogy, soil mechanics, aerial photo analysis, fluid dynamics, elasticity, regional planning, hydraulics and hydrology, and materials science and engineering.

Faculty

W. A. Bassett, J. M. Bird, A. L. Bloom, L. D. Brown, J. L. Cisne, B. L. Isacks, D. E. Karig, S. Kaufman, R. W. Kay, G. A. Kiersch, A. F. Kuckes, G. H. Morrison, J. E. Oliver, F. H. T. Rhodes, A. L. Ruoff, C. Sagan, W. B. Travers, D. L. Turcotte

Germanic Studies

Graduate Faculty Representative: Inta Ezergailis, 178 Goldwin Smith Hall

Major Subjects: German Literature, Germanic Linguistics

Minor Subjects: German Literature, Germanic Linguistics, Old Norse

A good background in German literature and fluency in the German language are required, as is some acquaintance with Middle High German. A reading knowledge of a foreign language other than German is desirable. Applicants must submit scores of the Graduate Record Examinations Aptitude Test. Both M.A. and Ph.D. degrees are granted, but preference is given to those planning to continue for the doctorate.

For the Ph.D. degree, proficiency in French (for literature majors) or in Russian (for linguistics majors) is required. A qualifying examination is required and is normally given by the end of the first year. For further details, see *The Guide for Graduate Students in German at Cornell University*, available from the graduate faculty representative. The doctoral program normally takes four years. Apprentice teaching is an essential part of the program. Provision is made for study abroad, if desirable. Course requirements for the master's degree can usually be completed within one year; a master's thesis is required only if the degree is to be a terminal one.

Special opportunities for study abroad include the Schurman Fellowship (for work at the University of Heidelberg), the *Dankstipendium* offered by the German Federal Republic, and the German Academic Exchange Service (DAAD) Fellowship.

The student with a major in German literature chooses for special emphasis one of three partially overlapping periods: German literature before 1700, German literature from 1500–1832, or German literature from 1750 on.

The program in Germanic linguistics aims at ensuring familiarity with the basic tools of research in linguistics and philology and at providing the student with a thorough knowledge of the structure of modern German, the contrastive analysis of German and English, the history of the German language, four of the older German languages, and comparative Germanic linguistics. Opportunities for studying Old Norse are exceptional; the University's collection of Old Norse materials (the Old Icelandic Collection) is probably the most important of its kind in the world, and its curator, Vilhjalmur Bjarnar, is both a librarian and an Old Norse scholar.

Faculty and Specializations

Literature

Medieval literature and philology: A. J. Berger, A. B. Groos, Jr.
The late Middle Ages, the sixteenth century: S. L. Gilman
The seventeenth century: H. Deinert, S. L. Gilman
The eighteenth century, the classical age: D. Bansberg, E. A. Blackall, S. L. Gilman, A. Groos, P. Hohendahl
Romanticism and realism: E. A. Blackall, H. Deinert, I. Ezergailis, P. Hohendahl

Twentieth-century literature: D. Bansberg, H. Deinert, I. Ezergailis, S. L. Gilman, P. Hohendahl, W. W. Holdheim
Stylistics: E. A. Blackall
Literary theory: P. Hohendahl, W. W. Holdheim

Linguistics
Old Norse: A. J. Berger, V. T. Bjarnar
Netherlandic, Frisian, Gothic, Old High German, Old Saxon, Early New High German, comparative Germanic grammar: F. van Coetsem
History of the German language, Modern German grammar: E. A. Blackall, H. L. Kufner
German dialects, applied linguistics, pedagogy: R. L. Jones, H. L. Kufner

Government

Graduate Faculty Representative: Isaac Kramnick, 132 McGraw Hall

Major and Minor Subjects: American Politics, Comparative Politics, Political Thought, International Relations

Minor Subject: Methodology of Politics, Public Policy. The latter is a minor field within the Graduate School at large (see p. 81) and is seen as an appropriate minor for students with a major in the Field of Government.

The field asks applicants to submit scores of the Graduate Record Examinations Aptitude and Advanced Tests.

Students are asked to acquire: (1) a thorough knowledge of the discipline, including substantial theoretical, conceptional, and substantive competence in a major interest, and a solid foundation in two minor subjects; (2) to provide a clear demonstration of the methodological, linguistic, or other skills needed to conduct scholarly and original research; (3) to acquire at least one term's experience as a teaching assistant. If students have not taken equivalent courses previously, they are expected to take three of the four field seminars in the major subjects.

Students are normally admitted only at the beginning of the academic year.

Early in the first semester, the new graduate student meets with the director of graduate studies and several faculty to discuss the first year's program. By midyear the student should form a Special Committee. In the second term, the faculty conducts a review of each student's progress, including an oral qualifying examination.

By the end of the third year of residence, or sooner if possible, the student is expected to have taken the admission to candidacy examination. The examination is given in two parts: (1) written examinations in the student's major and minor subjects and (2) an oral examination conducted by the Special Committee. The written examinations are normally given three times a year; the student may opt to take two written examinations at one time and the third later, providing this is done consecutively. Except under special circumstances, the field limits support to at most four years.

Students are normally not admitted to pursue only the master's degree. The master's degree is awarded after one year of course work of high quality and the presentation of a master's thesis. Where work is not of high quality, the field may require a third term of course work.

For both the Ph.D. and M.A. programs, the student is asked to prepare a statement of intellectual goals, showing the relationship of major and minor subjects, when a Special Committee is formed. At the admission to candidacy examination the student presents a thesis proposal, outlining the hypotheses, data, methods, and resources needed to successfully complete the dissertation.

Interdisciplinary Programs

Students are encouraged to take advantage of the numerous interdisciplinary programs including: the Program on Science, Technology, and Society; the Rural Development Program; and the Peace Studies Group of the Center for International Studies; the Public Policy Group associated with the Graduate School of Business and Public Administration; and the foreign area programs for Latin America, Southeast Asia, China and the Soviet Union. Members of the field who are also involved with the minor Field of Public Policy are noted in the following listing of interests.

Faculty and Specializations

American Politics
H. Alker: psychology and politics
D. J. Danelski: public law and judicial behavior
A. T. Dotson: public administration; public policy; presidency; bureaucracy
E. Eisenach: early American political thought
B. Ginsberg: elections; parties; public policy
E. W. Kelley: public policy
P. Leeds: psychology and politics
T. J. Lowi: presidency; parties; American liberalism; public policy
G. H. Quester: defense policy
M. Shefter: urban politics; parties
D. Van Houweling: urban politics; political economy

Comparative Politics
B. R. O'G. Anderson: Southeast Asia; militarism in industrial and agrarian societies
D. E. Ashford: England—comparative local politics, political development, public policy
M. Bernal: China—ideology and politics
A. T. Dotson: development administration
M. J. Esman: comparative public administration and political development; public policy
G. McT. Kahin: Southeast Asia
M. F. Katzenstein: India; ethnicity
P. J. Katzenstein: Western Europe; public policy
E. Kenworthy: Latin America; dependency in north-south relations
D. P. Mozingo: China; comparative revolutions
T. J. Pempel: Japan—political development, public policy
G. H. Quester: comparative foreign policies
M. Rush: Soviet Union—comparative communism, political succession

S. Tarrow: France and Italy—parties and elections, comparative communism
N. T. Uphoff: political economy; West Africa; development theory; public policy

Political Thought
W. J. Dannhauser: Hegel, Nietzsche; classical political philosophy
E. Eisenach: Hobbes, Locke, and the liberal tradition
I. Kramnick: 18th century Enlightenment; modern political thought
D. Resnick: contemporary political and social thought

International Relations
M. J. Esman: foreign aid; international flows of technology
G. McT. Kahin: U.S.-Asian relations
P. J. Katzenstein: political integration
D. P. Mozingo: foreign relations of China
G. H. Quester: foreign policy processes; arms control and disarmament
R. N. Rosecrance: international relations theory; defense strategies; political and economic interdependence
M. Rush: foreign relations of the Soviet Union
L. Scheinman: international organization and law

Methodology of Politics
H. Alker: psychological testing and attitudinal change
D. E. Ashford: cross-national comparison; survey research; political behavior
D. J. Danelski: quantitative judicial behavior
E. W. Kelley: coalition theory; mathematical and statistical reasoning; philosophy of science
D. Van Houweling: data analysis; computer simulation techniques

History

Graduate Faculty Representative: William B. Provine, 340 McGraw Hall

Major and Minor Subjects: American History, American Studies, Ancient History, Early Modern European History, English History, History of Science, Latin American History, Medieval Chinese History, Medieval History, Modern Chinese History, Modern European History, Russian History, Southeast Asian History

Applications for admission must include the scores of the Graduate Record Examinations Aptitude Test. Applications are accepted for the fall term only.

Each major subject area of study within the field formulates its own foreign language requirement.

Candidates majoring in the Field of History are permitted to choose one of their minor fields from other fields of the Graduate School.

Candidates for the Ph.D. in history are required to do classroom teaching as a part of their doctoral program. Most graduate students will serve for at least one year as teaching assistants in undergraduate courses. For some however, especially those with financial support from foundations or special agencies, some voluntary teaching under the supervision of a member of their graduate committee will be an acceptable alternative.

A department information sheet may be obtained by contacting the field.

Faculty and Specializations

D. A. Baugh: modern English history, 1688-1914: political, social, economic, and administrative; maritime history of Western Europe, 1600-1800
A. H. Bernstein: ancient history, Greek and Roman; Roman Republic; sixth- and fifth-century Greece
S. M. Blumin: American history: social, cultural, and demographic; American urban history; history of American religion
S. G. Cochran: modern Chinese history, 1644 to present: political, social, economic, and intellectual
L. Engelstein: modern Russian history, social and intellectual
T. H. Holloway: Latin American history; Brazil: social, economic, and political history in the national period
C. Holmes: early modern English history, 1450-1688: political, legal, social, and economic
J. J. John: medieval intellectual history; historiography; universities; Latin paleography
M. Kammen: early American history; historical thought and American culture; New York history
S. L. Kaplan: France, 1500-1848; comparative European social history; historical demography; quantitative approaches
D. LaCapra: modern European intellectual history
W. F. LaFeber: American history; United States foreign policy, 1750 to present
P. R. Metcalf: history of western America; American Indian history
R. L. Moore: American history, intellectual and cultural
J. M. Najemy: late medieval and Renaissance history; Italy, 1250-1559; Florence: political, socioeconomic, constitutional, and cultural history; intellectual history of western Europe, 1300-1600
M. B. Norton: American history, 1760-1850: social, political, and constitutional; history of women in America
C. A. Peterson: Chinese history in the period T'ang-Sung: political, military, administrative, and foreign relations, especially late T'ang and late southern Sung
W. M. Pintner: modern Russian history, 1700 to present, especially social, economic, military, and administrative history of the imperial period
R. Polenberg: modern American political and social history, 1930 to present
W. B. Provine: history of science; history of biology
J. H. Silbey: American history; political behavior, especially in the nineteenth century; the Age of Jackson; the sectional controversy; Civil War and Reconstruction; quantitative methods in history
F. Somkin: American cultural and intellectual history
B. Tierney: medieval church history; law; political theory
J. Weiss: modern European history, social and political; social history of technology
L. P. Williams: history of science; nineteenth-century physical sciences
O. W. Wolters: early Southeast Asian history; Vietnamese history to 1400.
D. K. Wyatt: modern Southeast Asian history; history of Thailand and Laos

History of Architecture and Urban Development

Graduate Faculty Representative: Stephen W. Jacobs, 114 West Sibley Hall

Major and Minor Subjects: History of Architecture, History of Urban Development, Preservation Planning (major for M.A. only)

Applicants should have an undergraduate degree in architecture, archaeology, planning, ecology, geography, history, history of culture, art, or architecture, or appropriate experience in the field. Applicants residing in the United States must submit scores of the Graduate Record Examinations Aptitude Test. Candidates may apply for the Master of Arts or for the doctoral program; applicants with previous graduate work will be considered for advanced standing. The master's program is intended to qualify students for research, teaching, specialized practice, or government service. The doctoral program is intended to prepare students to make creative contributions to the field. For M.A. candidates, reading proficiency in at least one modern language other than English is required; for Ph.D. candidates, proficiency in two languages other than English.

A limited number of teaching assistantships are available.

Research and Study Opportunities

The Department of Architecture cooperates with Harvard University in the archaeological exploration of Sardis in Turkey. Qualified students are encouraged to participate as architectural assistants on this and other expeditions in the Mediterranean area.

The Department of City and Regional Planning conducts a program of research in urban and regional studies in cooperation with the Program in Urban and Regional Studies (see p. 24). Research activities are closely related to and derived from faculty interests and specializations listed below.

Faculty and Specializations

W. W. Cummer: ancient architecture; history of preindustrial building; archaeology
S. W. Jacobs (Associate Director of the Cornell-Harvard Expedition to Sardis, Turkey): American architecture; preservation programs
B. G. Jones: historic preservation planning
C. F. Otto: history of Renaissance, baroque, and modern architecture
K. C. Parsons: history of college and university architecture and planning
J. W. Reps: history of city planning in the United States
C. Rowe: history of Renaissance and modern architecture; urban design; architectural criticism; contemporary European and American architecture
S. Stein: preservation planning
I. R. Stewart: American urban history; nineteenth-century landscape design

History of Art and Archaeology

Graduate Faculty Representative: Theodore M. Brown, 37 Goldwin Smith Hall

Major and Minor Subjects: American Art, Ancient Art and Archaeology, Medieval Art, Modern Art, Oriental Art, Renaissance and Baroque Art

An undergraduate major in the history of art is recommended but not required. All applicants are required to take the Graduate Record Examinations. Applicants should have already begun study of a language appropriate to their intended program; they must demonstrate reading proficiency in the language before becoming candidates for a degree. Each Ph.D. candidate must participate in teaching during at least two terms.

The department awards several teaching assistantships and a Kress Foundation Fellowship. The Franklin and Gretel Goldring Memorial Fellowship provides summer travel support in Europe for several advanced students.

Research and Study Opportunities

Major study facilities are provided by the collections of Olin Library, which contain resources of primary material for this field, and by the Fine Arts Library in Sibley Hall, with extensive holdings in art and architectural history. The Herbert F. Johnson Museum of Art, which has in its permanent collection significant study material, offers opportunities to gain experience in the operations of the museum. In addition to the major collections in New York City, Ithaca is within reasonable distance of the Albright-Knox Art Gallery in Buffalo, the Memorial Art Gallery in Rochester, and the Munson-Williams-Proctor Institute in Utica. The Department of the History of Art has a study collection of photographs of works of art and a rapidly expanding collection of over 200,000 slides.

Interdepartmental programs are available in archaeology and in medieval studies, and descriptive pamphlets will be sent on request. The Department of Asian Studies also issues a publication describing facilities in Far Eastern studies. A study archive of Chinese art is being developed.

Faculty and Specializations

American art: T. W. Leavitt, A. S. Roe
Ancient art and archaeology: J. E. Coleman, A. Ramage
Medieval art and architecture: R. G. Calkins
Modern art: J. V. Falkenheim, R. C. Hobbs, T. W. Leavitt
Nineteenth-century art and modern architecture: T. M. Brown
Oriental art: S. J. O'Connor, M. W. Young (Chinese and Japanese art)
Renaissance and baroque art: E. G. Dotson, C. E. Gilbert, H. P. Kahn (graphics), A. S. Roe

Hotel Administration

Graduate Faculty Representative: Stanley W. Davis, Statler Hall

Major Subjects: Hotel Accounting, Hotel Administration

Minor Subjects: Food and Beverage Management, Hotel Accounting, Hotel Administration, Personnel

Administration and Training, Properties Management, Travel Industry Management

The field offers the following degrees: Doctor of Philosophy, Master of Science, and Master of Professional Studies (Hotel Administration). The Ph.D. degree program is specifically aimed at preparing those exceptional students who plan to teach at the college level or to do research in the field. The M.S. is also aimed at preparing teachers and researchers. The M.P.S. degree is a professional terminal degree designed to train those who plan to become hotel or restaurant operators and managers.

Candidates for the Ph.D. must have completed a master's or bachelor's degree in hotel administration at Cornell University. Candidates for the M.S. must have completed the B.S. in hotel administration at Cornell.

There are three different approaches to the M.P.S. (H.Ad.) degree depending upon the applicant's prior study: (1) for those with a bachelor's in a field other than hotel administration 64 credit hours (two years minimum) will be required; (2) for those with a B.S. in hotel administration 48 to 64 credit hours (one and one-half to two years) will be required; and (3) for those with a B.S. in hotel administration from Cornell University 32 credit hours (one year minimum) will be required. In addition to the course hours, one unit of practice credit, as defined in the *Announcement of the School of Hotel Administration,* must be earned between the time of matriculation and award of degree. A master's monograph must be presented during the last term of work for this degree.

Each applicant must show evidence of significant experience in the hospitality industry or in a related field. Further, it is required that each candidate arrange for a personal interview with a representative of the Graduate Admissions Committee of the School of Hotel Administration. Not all prospective students can readily come to Ithaca; therefore, arrangements have been made with graduates and others active in the hotel and restaurant business to serve as interviewers in most of the principal cities of the world. A time and place for this interview should be requested from the Graduate Faculty Representative, School of Hotel Administration, Statler Hall.

The deadline for submitting an application for fall admission is February 1. The deadline for completion of the application materials and personal interview is March 1. A few admissions are made in January, for which the application deadline is October 1. All supporting materials must be provided by November 1.

Faculty and Specializations

Accounting and financial management: D. C. Dunn, A. N. Geller
Economics: W. H. Kaven
Food and beverage management: V. A. Christian, P. Rainsford
Hotel management: R. A. Beck, P. L. Gaurnier
Law: J. E. H. Sherry
Microbiology and sanitation: J. C. White
Properties management: J. J. Clark, M. H. Redlin
Psychology: S. W. Davis

Human Development and Family Studies

Graduate Faculty Representative: Lee C. Lee, G-52 Martha Van Rensselaer Hall

Major Subjects: Developmental Psychology, Human Development and Family Studies.

Minor Subjects: Atypical Development, Cognitive Development, Early Childhood Education, Family Relationships, Social and Personality Development

Most successful applicants have undergraduate majors in psychology, sociology, child development, or family relationships, but students of high ability may be admitted regardless of undergraduate background. All applicants are required to submit their scores on the Graduate Record Examinations Aptitude Test.

The principal aim of the graduate program is to train students as researchers and college teachers. It does not prepare students to be clinical psychologists, school psychologists, or family life counselors.

All students are expected to acquire a basic background in the behavioral sciences and to master a broad base of knowledge of human development and the family within the social context.

The degrees offered are the M.A., M.S., and Ph.D. One semester of graduate-level training in statistics is required of all master's degree candidates, and two semesters of all Ph.D. candidates. The master's degree as well as the Ph.D. requires a research thesis. The field requires a predoctoral research project to be completed at the end of the second year of study. Some teaching experience is required for degree candidates. Master's degree programs ordinarily require two years for completion; doctoral programs, four years. The policy of the field is to attempt, whenever possible, to provide financial support for master's degree candidates during their first two years of study and for Ph.D. candidates during their first four years of study, provided that their work is satisfactory. New and continuing students are supported in roughly the same proportions.

Special Facilities and Programs

About one-half of the research in the Field of Human Development and Family Studies is conducted in the departmental laboratories and nursery school; the other half is done off campus in various community settings. The departmental nursery school maintains half-day programs for children from diverse backgrounds. An art laboratory is available for the investigation of creative activities in children from two to fifteen years of age. Several small experimental rooms and two large rooms are equipped with one-way vision screens and modern sound recording equipment. In addition, closed-circuit television facilities are available for teaching and

research. The Family Life Development Center, operating on an HEW grant, is a resource and demonstration center concerned with child abuse and maltreatment. It is possible for students to become involved in research or public service in connection with the center.

The department maintains close relationships off campus with many of the public schools, nursery schools, day care centers, youth service agencies, and counseling services in Tompkins County. A great deal of departmental research is conducted in these settings.

The field maintains close relationships with the Fields of Psychology and Sociology.

Faculty

H. T. M. Bayer, A. W. Boykin, W. L. Brittain, U. Bronfenbrenner, M. M. Cochran, J. C. Condry, W. Cross, E. C. Devereux, Jr., J. Doris, H. Feldman, E. J. Gibson, S. Hamilton, J. S. Harding, B. Koslowski, W. W. Lambert, J. L. Laws, L. C. Lee, H. Levin, B. Lust, U. Neisser, M. Potts, H. N. Ricciuti, B. Richardson, B. C. Rosen, R. Savin-Williams, J. M. Stycos, G. J. Suci, J. Weisz

Human Service Studies

Graduate Faculty Representative: Helen Nelson, N-136 Martha Van Rensselaer Hall

Major and Minor Subjects: Community Service Education; Home Economics Education

The Graduate Field of Human Service Studies at Cornell University offers concentrations in the design and development of human services, in the evaluation of social programs, and in preparation for teaching human service professions. Students enrolled for either the Ph.D. degree or the M.S. degree (offered through the Graduate School) or the Master of Professional Studies [M.P.S. (Human Ecology)] degree, offered through the College of Human Ecology and the Graduate School, are expected to have had professional training and experience in an agency providing direct services to people. Typically, students in this program have been social workers, community agency executives, health and mental health professionals, and leaders in local and state voluntary agencies. Graduates are working in the federal, state, regional, and local agencies as executives, program planners, evaluators, policy and budget analysts, and as university faculty in professional education programs.

The research and public service programs engaged in by faculty and student members of the field reflect this same range of interests and relationships to public agencies. Recent and current projects and clients include:

A policy-options and program design study of The Supplemental Security Income Program for the office of the Governor of New York.
An evaluation of the social planning processes of each of the fifty states for the U.S. Department of H.E.W.
An evaluation of the Expanded Food and Nutrition Education Program of the Department of Agriculture.
An assessment of possible social and institutional impacts of alternative plans for development of the Hudson River basin for the New York State Department of Environmental Conservation.
An evaluation of a family day-care resource program funded by the Carnegie Corporation.
A study of the long-term effects of preschool education for the Education Commission of the States.
A study of the use of needs-assessment data in local decision-making processes.

Additionally, faculty and students are heavily engaged in programs of continuing education for practicing professionals and staff in public agencies. In 1977 these programs included in-service training for staffs of eleven county departments of social service, for teachers of home economics, for vocational education teachers, and for County Extension agents. Currently under development are programs for the training of mental hospital personnel to serve as community mental health workers and a program to help local agencies develop self-evaluation skills.

Graduate Study

Graduate work at Cornell is organized around common-interest fields, rather than departments of colleges, and field members may come from any department or unit of the University. The Field of Human Service Studies is located in the Department of Community Service Education of the New York State College of Human Ecology, one of four statutory colleges of the State University of New York which are part of Cornell University and located on its Ithaca campus.

The graduate Field of Human Services has no fixed course or credit requirements for a graduate degree. The candidate's program, mapped out with his or her Special Committee, is based upon the student's goals and background; it will often consist of a combination of courses from any appropriate source, independent study and research, participation in ongoing research, educational and public service programs, and field experience. When the student has satisfied the plan of study and has passed a qualifying examination, he or she then writes a thesis, and upon its acceptance by his or her Special Committee, will receive a degree.

Faculty and Specializations

R. J. Babcock: vocations and career development
D. J. Barr: community mental health; group processes; leadership
S. Blackwell: evaluation methodology; home economics education
R. Bruce: adult and community education; international education
K. Bryant: welfare economics; social policy
I. D. Deshler: adult and community education; group and community processes and change
J. Egner: educational policy and administration

R. Ehrenberg: evaluation methods; economics of public services
C. Farris: home economics education; sex role stereotypes in schools
L. J. Ford: planning and origin of health services; epidemiology; alcoholism
J. Gerner: welfare economics and public policy
A. Hahn: community decision making; intergovernmental relationships
D. Hedlund: group development; organizational behavior
I. Lazar: design and evaluation of human service programs; infant and preschool services
C. C. McClintock: evaluation and survey methodology; organizational behavior
J. Millman: educational measurement and evaluation
M. Minot: home economics education; competency-based certification
B. J. Mueller: social work education; adult development; service systems design
H. Nelson: evaluation methodology; home economics education
L. Noble: adult learning and development; public service systems
K. Rhodes: higher education; role of women in developing nations; home economics education
R. Risley: manpower studies; organizational development and behavior; intergroup relations
R. C. Rist: social policy; policy analyses; studies of school desegregation and of migrant families; evaluation research
E. F. Roberts: legal and institutional aspects of planning and development
S. Stein: economic and social planning; resource development
L. C. Street: intergroup relations; criminology; social policy; ethnographic methods
B. L. Yerka: organization and evaluation of informal adult and community education programs

Industrial and Labor Relations

Graduate Faculty Representative: Robert L. Aronson, 101 Ives Hall

Major and Minor Subjects: Collective Bargaining, Labor Law, and Labor History; Economic and Social Statistics; International and Comparative Labor Relations; Labor Economics; Organizational Behavior; Personnel and Human Resource Management

Minor Subject Only: Industrial and Labor Relations Problems (available only for students majoring in other fields)

Applicants whose native language is English are required to take the aptitude portion of the Graduate Record Examinations. For admission to the Ph.D. program, a master's degree or its equivalent is usually required; direct admission is possible in cases of exceptional promise.

The Master of Industrial and Labor Relations program is designed to provide broad coverage within the field and some opportunity for advanced specialized work. It requires four semesters, and a total of fourteen courses, eight of which are required. The requirements for this degree are fulfilled by satisfactory performance in these courses.

The final examination for the Master of Science degree includes a test of subject matter competence in the major and minor subjects and a defense of the master's thesis. The examination is both written and oral.

The field may administer a preliminary examination prior to admitting students to the doctoral program. The acquisition of teaching experience during study for the doctorate is required.

Faculty and Specializations

Collective Bargaining, Labor Law, and Labor History
R. Donovan, chairperson; D. E. Cullen, C. Daniel, R. E. Doherty, J. A. Gross, K. L. Hanslowe, R. R. Keeran, T. Kochan, A. G. Korman, D. B. Lipsky, R. B. McKersie, J. O. Morris, P. Ross, J. P. Windmuller

Faculty members specialize in the following three areas: (1) the study of the legal framework within which labor-management relations systems in the United States have developed; (2) the study of the history and structure of various components of the American trade union movement at the local, national, and confederation levels; and (3) the study of institutions, practices, and principles relevant to understanding how interested parties resolve conflicts over the conditions of the labor contract.

Economic and Social Statistics
P. J. McCarthy, chairperson; I. Blumen, I. Francis, P. Velleman

Faculty members are mathematical statisticians interested in the application of their area of expertise to the social studies. They offer students an opportunity to study how the tools of mathematical statistics help in describing and analyzing socioeconomic phenomena and how various hypotheses can be tested quantitatively.

International and Comparative Labor Relations
J. P. Windmuller, chairperson; M. G. Clark, W. Galenson, G. H. Hildebrand, W. F. Whyte

This area of study deals with two major problems: a comparative analysis of the ways in which industrial societies other than the United States handle labor market problems; and the study of social institutions and economic conditions that facilitate or impede development in developing countries.

Labor Economics
R. Ehrenberg, chairperson; R. L. Aronson, M. G. Clark, R. H. Ferguson, W. Galenson, G. H. Hildebrand, R. Hutchens, F. Slavick, R. Smith

Scholarly interests of students in labor economics lie primarily in two directions. Some seek to generalize about the ways in which movements of prices, wages, and workers are related and to study the mechanisms of various labor markets. Others examine private and public programs designed to insure the working population against those risks of living in an industrial society which can be expressed in money terms.

Organizational Behavior
L. K. Williams, chairperson; H. E. Aldrich, S. B. Bacharach, L. W. Gruenfeld, T. H. Hammer, N. A. Rosen, R. N. Stern, H. M. Trice, W. F. Whyte

This department is staffed by behavioral scientists,

including psychologists, social psychologists, sociologists, and cultural anthropologists. Opportunity is offered for study of the nature of industrial society as a context for complex work organizations, the study of such organizations *per se*, or the study of the behavior of small groups and individuals which are components of such organizations.

Personnel and Human Resource Management
W. B. Wolf, chairperson; T. DeCotiis, L. D. Dyer, J. Farley, F. F. Foltman, W. W. Frank, F. B. Miller, R. F. Risley, W. J. Wasmuth

Personnel and human resource management has two main facets. First, the conventional study of the personnel function is directed at understanding how the single employing organization deals with its human resources. Second, the study of manpower supply and training problems at the community and national levels is increasingly a matter of critical public policy.

International Agricultural and Rural Development

Graduate Faculty Representative: J. F. Metz, Jr., 261 Roberts Hall

Major and Minor Subject: International Agricultural and Rural Development [major for the M.P.S.(Agr.) degree only]

This field is *intended primarily* for the student preparing for service in international agriculture and draws from several disciplines to assist the student in understanding the special conditions and problems of newly developing economies. While this minor, which is intended for international students as well as for those from the United States, is planned specifically for students majoring in one of the graduate fields in agriculture and life sciences, other qualified students are welcome. Students minoring in this field are encouraged to become proficient in that language which will most likely be useful in their intended area of service.

Students may not minor in this field if they are minoring in one of the area programs such as Asian studies or Latin American studies, and they may not select a professor for this minor who also serves on the graduate faculty in their major field.

The field offers an M.P.S.(Agr.) degree for students interested in the broader, more interdisciplinary aspects of agricultural and rural development. The program provides an opportunity for study of development strategies, a broad perspective on practices and trends in world agriculture, and up-to-date training in a discipline. The curriculum is especially relevant to mature and experienced practitioners in development activities from the United States and abroad.

Faculty and Specializations

M. Alexander: agronomy
R. W. Arnold: agronomy
M. L. Barnett: rural sociology
C. W. Boothroyd: plant pathology
D. R. Bouldin: agronomy
M. C. Bourne: food science and technology (Geneva)
F. B. Cady: plant breeding and biometrics
T. C. Campbell: nutritional sciences
H. R. Capener: rural sociology
J. M. Cohen: rural sociology
R. D. Colle: communication arts
E. W. Coward, Jr.: rural sociology
R. H. Crawford: communication arts
L. V. Crowder: plant breeding
E. W. Cupp: entomology
H. R. Cushman: education
E. C. Erickson: rural sociology
M. J. Esman: international studies
D. K. Freebairn: agricultural economics
F. H. Golay: economics
V. E. Gracen: plant breeding
D. J. Greenwood: anthropology
W. K. Jordan: food science
W. C. Kelly: vegetable crops
F. V. Kosikowski: food science
M. C. Latham: nutritional sciences
D. J. Lathwell: agronomy
G. Levine: agricultural engineering
R. E. McDowell: animal science
J. F. Metz, Jr.: international agriculture
A. Milnor: rural sociology
R. A. Morse: entomology
H. M. Munger: plant breeding
G. W. Olson: agronomy
R. L. Plaisted: plant breeding
T. T. Poleman: agricultural economics
K. L. Robinson: agricultural economics
M. L. Scott: poultry science
T. W. Scott: agronomy
D. G. Sisler: agricultural economics
E. H. Smith: entomology
K. H. Steinkraus: food science and technology (Geneva)
E. L. Stone, Jr.: agronomy
R. D. Sweet: vegetable crops
H. D. Thurston: plant pathology
W. M. Tingey: entomology
N. T. Uphoff: international studies
A. Van Wambeke: agronomy
D. H. Wallace: plant breeding
F. W. Young: rural sociology

International Development

Graduate Faculty Representative: J. Mayone Stycos, 170 Uris Hall

Major Subject: International Development

The field offers graduate training leading to the degree Master of Professional Studies (International Development) [M.P.S.(I.D.)]. It provides an interdisciplinary course of study for experienced practitioners in international development who seek to upgrade or update their educational qualifications in areas of direct relevance to their professional careers. The program offers training both in a substantive specialization—population, regional planning, science and technology policy, or nutrition—and in methods of analysis for implementing objectives—development administration and planning, development economics, development politics, development sociology, or international communi-

cation. While applicants should have a strong academic background, excellent professional performance will be given a large weight in evaluating the applicant's admissibility. Most applicants will be expected to have complete funding from outside sources.

The degree program consists of at least thirty credit hours of course work, of which six credit hours will normally consist of an applied research project. Approximately half of this work will be in one of the four substantive specializations and half in one or more of the methods of analysis. Candidates can expect to complete their degree requirements within a time period of eleven to eighteen months. Where more work in the substantive specialization is desired, the candidate is expected to do it in a summer of work before or after the academic year, or in an additional term of work.

Faculty and Specializations

Population
R. C. Avery, P. S. K. Chi, R. D. Colle, R. H. Crawford, M. Haines, J. M. Stycos

Regional Planning
W. W. Goldsmith, B. G. Jones, D. B. Lewis, S. Saltzman, D. F. Williams

Science and Technology Policy
E. T. Cranch, T. E. Davis, M. J. Esman, D. B. Lewis, F. A. Long, J. W. Mellor, W. F. Whyte

Nutrition
T. C. Campbell, J. Haas, M. C. Latham, D. A. Roe, D. M. Sanjur, R. Schwartz, D. G. Sisler

Methods of Analysis
D. E. Ashford, M. L. Barnett, F. Bent, J. Cohen, J. W. Converse, E. W. Coward, Jr., E. Erickson, F. H. Golay, E. Thorbecke, N. T. Uphoff, F. W. Young

Professors mentioned under the four substantive specializations may also work in methods of analysis for international development.

Landscape Architecture

Graduate Faculty Representative: Leonard J. Mirin, B-40 East Sibley Hall

Major and Minor Subject: Landscape Architecture

Two-Year Graduate Program

The two-year Master of Landscape Architecture (M.L.A.) program serves to broaden and enrich undergraduate education in design by providing an expanded educational experience to those who are technically skilled. Applicants are therefore expected to hold a bachelor's degree in architecture, landscape architecture, or environmental design from a recognized institution.

The objectives of the two-year program are to permit students to conduct research in the multidisciplinary areas relating to landscape architecture, and to provide advanced education and training to individuals who decide, upon graduation, to teach, to practice, or to conduct applied research in landscape architecture. To further these objectives, students are permitted considerable flexibility in establishing programs which take full advantage of the teaching and research resources of the University.

Three-Year Graduate Program

Students with bachelor's degrees in areas other than architecture, landscape architecture, or environmental design may enroll in the three-year M.L.A. program. Through an initial curriculum sequence intended to develop basic landscape architecture skills and concepts, the three-year program provides opportunities for students from diverse educational backgrounds to become proficient in landscape design, site construction, graphic communication, plant materials and other related subject areas necessary to enter the profession fully qualified at the master's level. In order to provide advanced education and training for those who decide to conduct applied research, to practice, or to teach in landscape architecture, students are also encouraged to pursue multidisciplinary studies based upon an individualized curriculum developed under the guidance of an adviser in the Field of Landscape Architecture.

Admission

Applications should include a record of undergraduate academic performance, letters of recommendation, a statement describing the applicant's background and objectives, and any examples of work which may illustrate the applicant's potential for achievement at the graduate level. Graduate Record Examination scores are desirable but not required. For further information prospective students should write to the graduate faculty representative.

Curriculum and Requirements

For students enrolled in the two-year program, sixty credits constitute the course work requirement. Two academic years constitute the minimum residence requirement. A student may petition the Graduate School for a maximum of one semester's advanced standing based upon previous education or experience.

Ninety credits, including satisfactory completion of the core curriculum courses, fulfills the course work requirement of the three-year M.L.A. program.

Two-year and three-year M.L.A. program students are required to choose a minor area of concentration. This consists of a minimum of fifteen credits of course work and may be chosen from any of the relevant fields in the Graduate School, or from subject areas such as the ecologic, economic, social, historical, or legal determinants of landscape architectural design.

In addition to satisfactory completion of course work, requirements for the M.L.A. degree include an approved summer internship and completion of a thesis or final project.

Faculty and Specializations

M. I. Adleman: landscape architecture
D. J. Allee: resource economics
R. W. Crump: architectural technology
K. H. Grey: urban design, site planning, and land-use planning
L. S. Hamilton: natural resources
E. E. Hardy: land-use inventories and remote sensing
S. W. Jacobs: history of architecture and urban development
T. H. Johnson: landscape architecture
B. G. Jones: urban and regional quantitative analysis and environmental health planning
T. Liang: remote sensing
A. S. Lieberman: physical environmental quality
L. J. Mirin: landscape architecture
R. G. Mower: ornamental horticulture
C. W. Pearman: architectural design
M. L. Schack: architectural design and urban design
J. P. Shaw: architectural design
S. W. Stein: land-use planning and urban design
P. J. Trowbridge: landscape architecture
O. M. Ungers: architectural design

Latin American Studies

Graduate Faculty Representative: W. W. Goldsmith, 200 West Sibley Hall

Minor Subject: Latin American Studies

Latin American studies is a *minor* field of concentration at Cornell; consequently a prospective student must first be admitted to a *major* field of the Graduate School. Subsequent to admission, a student elects a minor in Latin American studies by inviting a member of the graduate faculty who represents this area to sit on the Special Committee.

Direct field research experience provides opportunity to investigate a problem in Latin America by utilizing the tools of the major discipline and usually generates the data on which the Ph.D. or master's thesis is based. Faculty members from various academic fields are currently engaged in research or fieldwork in many Latin American countries and are usually able to counsel scholars who are comparatively new in the area.

Faculty

S. Barraclough, L. V. Crowder, T. E. Davis, D. K. Freebairn, R. K. Goldsen, W. W. Goldsmith, J. S. Henderson, T. H. Holloway, B. J. Isbell, J. A. Kahl, E. E. Kenworthy, L. Kerr, L. D. King, T. F. Lynch, R. E. McDowell, J. V. Murra, T. T. Poleman, B. C. Rosen, J. F. Scott, D. F. Solá, J. M. Stycos, M. A. Suñer, H. D. Thurston, A. R. Wambeke, W. F. Whyte, L. K. Williams, F. W. Young

Law

Graduate Faculty Representative: John J. Barceló, III, 404 Myron Taylor Hall

Major and Minor Subject: Law

The Master of Laws (LL.M.) and the Doctor of Science of Law (J.S.D.) degrees are conferred. The former is intended for the students who desire to increase their knowledge of law by work in a specialized field. The latter is intended for students who desire to become legal scholars and to pursue original investigations into the function, administration, history, and progress of law.

The minimum residence requirement is two full semesters, but completion of the LL.M. program usually requires one summer in addition, and the J.S.D. program normally requires three to four semesters. Longer periods may be required. Candidates for either degree are ordinarily expected to concentrate on one legal field and do a substantial amount of work in at least one other field.

Students who meet the requirements for admission to the Graduate School's Division of Law but who do not wish to become candidates for a degree may, at the discretion of the faculty, be admitted as noncandidates.

Applicants for admission for an LL.M. or J.S.D. degree are expected to hold both a baccalaureate degree and a degree of Doctor of Law (J.D.) or a degree of equivalent rank from an approved law school. An applicant for admission for a J.S.D. degree must also have had professional practice or experience in teaching or advanced research. Applicants should state in as much detail as possible the objective for which they wish to do advanced graduate work and the particular fields of study they wish to pursue.

Applicants from other countries can be considered for degree candidacy only if they have completed with distinction all the studies necessary for admission or licensing for the practice of law in their own country.

For further details, see the *Announcement of the Law School.* Each candidate must pass examinations in courses taken for credit, an oral examination, and any other examinations required by the Special Committee.

A thesis or its equivalent is required of LL.M. candidates and a scholarly dissertation of J.S.D. candidates.

Special research and study opportunities exist at Cornell in city and regional planning, comparative law, commercial law, copyright and trademark law, corporation law, criminal law, environmental law, government contracts, industrial and labor relations, international legal studies, legislation, and property law. See also the description of the International Legal Studies Program in the *Announcement of the Law School.*

Faculty

A. Aman, Jr., D. Baker, J. J. Barceló, III, G. R. Blakey, K. M. Clermont, R. C. Cramton, W. D. Curtiss, W. T. Dean, W. R. Forrester, O. Garibaldi, W. C. Gifford, Jr., A. Gunn, K. L. Hanslowe, H. G. Henn, W. E. Hogan, J. B. Jacobs, I. R. Macneil, P. W. Martin, L. I. Palmer, N. Penney, D. L. Ratner, E. F. Roberts, Jr., F. F. Rossi, R. S. Summers, G. Thoron, I. Younger, J. T. Younger

Linguistics

Graduate Faculty Representative: R. B. Jones, Jr., 203 Morrill Hall

Major Subjects: General Linguistics, Teaching of English as a Second Language (M.S.)

Minor Subjects: Applied Linguistics, English Linguistics, General Linguistics, Sociolinguistics

The Graduate Record Examination is required of all applicants to the Field of Linguistics.

In addition to the M.A. and Ph.D. degrees, an M.S. degree is offered in the teaching of English as a second language. This is a two-year program and applicants should be sufficiently well prepared on admission to begin research on the thesis by the end of the first term of residence.

Candidates for the M.A. and M.S. degrees are required to demonstrate a reading knowledge of one language other than their native language. Ph.D. candidates are required to demonstrate a reading knowledge of two languages other than their native language, at least one of which must be either English, French, German, or Russian. The requirement may be satisfied in French, German, Spanish and Russian by taking the College Entrance Examination Board test or the Graduate Record Examinations Advanced test, achieving scores acceptable to the linguistics faculty. In other languages the requirement may be satisfied by special examination administered by an appropriate member of the faculty.

For the Ph.D., a qualifying examination is required in addition to the examinations required by the Graduate School. It is not required that a masters degree be earned prior to the Ph.D. degree.

A broad scope of offerings in both pure and applied linguistics is available, including not only courses in general linguistics, but also language-specific courses in East Asian linguistics (China, Japan), South Asian linguistics (Sri Lanka, India, Pakistan), and Southeast Asian linguistics (Burma, Indonesia, Philippines, Thailand, Vietnam), as well as the Indo-European languages.

Specialization in linguistics is provided by several other fields of the Graduate School. Minor subjects offered by other fields are East Asian linguistics, South Asian linguistics, and Southeast Asian linguistics in Asian Studies; Indo-European linguistics in Classics; Chinese linguistics and Japanese linguistics in East Asian Literature. The Field of Germanic Studies has majors and minors in Germanic linguistics. The Field of Romance Studies offers majors and minors in French, Italian, Romance, and Spanish linguistics. The Field of Slavic Studies offers majors and minors in Slavic linguistics. The Field of Psychology offers majors and minors in Psycholinguistics. All of these offerings will be found in this *Announcement* under the various fields.

Faculty and Specializations

L. H. Babby: Slavic linguistics; syntactic theory
N. C. Bodman: Chinese linguistics; Chinese dialects; Sino-Tibetan linguistics
J. S. Bowers: transformational grammar; syntax and semantics; general linguistics
J. M. Echols: Malayo-Polynesian; modern Scandinavian
J. W. Gair: South Asian and general linguistics
J. E. Grimes: general linguistics; discourse; phonetics; computational linguistics; indigenous languages of the Americas
J. Herschensohn: French linguistics
C. F. Hockett: anthropological linguistics
F. E. Huffman: Southeast Asian language and linguistics; field methods
R. B. Jones, Jr.: Southeast Asian language and linguistics; comparative and historical linguistics
R. L. Jones: German; applied and computational linguistics
E. H. Jorden: Japanese language and linguistics; language pedagogy
R. E. Kaske: English linguistics
G. B. Kelley: sociolinguistics; Dravidian linguistics
L. D. King: Portuguese and Spanish linguistics
W. H. Klemme: Spanish linguistics
H. L. Kufner: Germanic linguistics
R. L. Leed: Russian phonology; historical linguistics; language pedagogy
S. McConnell-Ginet: general linguistics; semantic theory; sex differentiation in language
J. McCoy: Chinese and Japanese linguistics; Chinese dialects
G. M. Messing: Indo-European; Classical languages; Balkan philology
J. S. Noblitt: French linguistics; second language acquisition
D. F. Solá: language policy; sociolinguistics; syntactic theory; Quechua language
G. J. Suci: psycholinguistics and language acquisition
M. Suñer: Hispanic linguistics; general and applied linguistics
F. van Coetsem: Germanic linguistics
J. F. Vigorita: Celtic linguistics; Indo-European
L. R. Waugh: French and general linguistics; semantics; Jakobsonian theory
J. U. Wolff: Indonesian and Philippine linguistics

Materials Science and Engineering

Graduate Faculty Representative: D. N. Seidman, 130 Bard Hall

Major and Minor Subjects: Materials Science, Materials and Metallurgical Engineering

Students from any undergraduate engineering or physical science program may be accepted. It is strongly recommended, but not required, that applicants submit the results of the Graduate Record Examinations.

Research and Study Opportunities

The following is a list of current areas of advanced study and research. The materials of interest include metals, semiconductors, ionic solids, ceramics, polymers, and glasses.

Mechanical behavior: plastic deformation and the strength of solids, fracture, embrittlement

phenomena, anelasticity, crazing and fracture of polymers
Imperfections in solids: point defects, dislocation mechanics, planar defects in silicon, defect interactions, radiation damage, grain boundaries, structural studies of polymers and biopolymers, diffraction studies with synchrotron radiation
Phase transformations: solidification, precipitation, martensite, phase decomposition during sintering, nonstoichiometry in ceramic systems
Surface structure and reactions: solid-liquid and solid-gas interfaces, field-ion and atom-probe microscopy, surface diffusion, low-energy electron diffraction, oxidation, segregation, catalysis, secondary electron spectroscopy, electron tunneling spectroscopy and synchrotron radiation photoelectron spectroscopy, reduction of oxides by gases
Microprocessing: submicron particle production, submicron grain polycrystalline production, submicron lamellar structures, very thin films
High-temperature materials: composite materials, refractory metals and alloys, sintering of ceramics
High-pressure studies: creep, diffusion, elastic constants, equation of state, synthesis, electrical properties, metallic hydrogen
Electrical and magnetic behavior: superconductivity, semiconductors, NMR, conduction in oxides and amorphous materials, magnetic domain wall motion, properties of layered structures, fast-ion conductors
Development of advanced experimental techniques: high-resolution electron microscopy, X-ray, high pressure, crystal growing, purification methods
Nuclear materials: reactor materials, radiation damage, mechanical properties
Biomedical materials: mechanical properties, structure and phase transitions in collagen, blood compatibility (clotting) on collagen, artificial kidney membrane materials
Geological materials: mechanical properties, effects of pressure and environment on diffusion

More detailed information about course programs and research areas is available upon request

A strong catalyst for the materials research activities at Cornell has been provided by the Materials Science Center, which provides substantial financial assistance for graduate students as well as maintaining central research facilities.

Professional Degree

The program leading to the professional degree of Master of Engineering (Materials) provides advanced courses designed to enlarge the student's preparation for a career in professional engineering, with less emphasis on research. For further information, see *Graduate Study in Engineering and Applied Science at Cornell.*

Faculty

D. G. Ast, R. W. Balluffi, B. W. Batterman, J. M. Blakely, M. S. Burton, L. C. De Jonghe, E. W. Hart, H. H. Johnson, D. L. Kohlstedt, E. J. Kramer, C. Y. Li, R. Raj, T. N. Rhodin, A. L. Ruoff, S. L. Sass, D. N. Seidman, B. M. Siegel, J. Silcox, F. O. Slate, W. W. Webb

Mathematics

Graduate Faculty Representative: C. J. Earle, 124 White Hall

Major and Minor Subject: Mathematics

Prerequisites for admission are a knowledge of advanced calculus (including both theoretical and applied points of view) and modern algebra.

The field requires a reading knowledge of German or Russian for the Ph.D. degree. There is no formal French requirement, but books and papers in that language will be freely used in all graduate courses, and students can expect to be called upon to read French mathematical texts.

The field requires teaching experience of all graduate students. Candidates for the master's degree are expected to obtain some understanding of mathematical thought, ordinarily by taking twenty-four hours of courses at the graduate level. Qualifications for the Ph.D. degree include a broad acquaintance with the basic subjects of present-day mathematics and a demonstration of ability to do research in one or more branches of mathematics.

All of the three major subdivisions of mathematics (algebra, analysis, and geometry) are well represented at Cornell. The department is also very strong in logic, probability, and statistics.

Additional information about courses, thesis and examination requirements, and research in mathematics is contained in a booklet entitled *Graduate Work in Mathematics at Cornell,* which may be obtained by writing to the graduate faculty representative. A detailed listing of the research interests of the members of the faculty will be sent with the booklet.

Special Minor in Mathematics: The Field of Mathematics has instituted a special minor. For details, contact the graduate faculty representative.

Faculty

I. Berstein, J. H. Bramble, K. S. Brown, S. U. Chase, M. M. Cohen, R. K. Dennis, E. B. Dynkin, C. J. Earle, A. Edmonds, R. H. Farrell, M. P. Finster, M. E. Fisher, W. H. J. Fuchs, S. S. Gelbart, S. Goldstein, L. Gross, R. S. Hamilton, D. W. Henderson, J. H. Hubbard, P. J. Kahn, H. Kesten, J. Kiefer, A. W. Knapp, D. Kubert, S. Lichtenbaum, G. R. Livesay, O. A. McBryan, M. D. Morley, A. Nerode, L. E. Payne, R. A. Platek, C. Queen, A. Rosenberg, O. S. Rothaus, A. H. Schatz, S. Sen, R. Shore, A. Sommese, F. L. Spitzer, R. S. Strichartz, M. E. Sweedler, L. Wahlbin, H. C. Wang, J. E. West

Mechanical Engineering

Graduate Faculty Representative: K. E. Torrance, 289 Grumman Hall

Major and Minor Subjects: Mechanical Design, Thermal Power, Thermal Processes

Minor Subject: Materials Processing

Applicants for an M.S. or Ph.D. program should have the equivalent of fundamental work required in an accredited undergraduate curriculum in the area of their major work. Those without adequate preparation may be required to make up the deficiency.

For the Ph.D. degree candidates must demonstrate reading ability in one of the following languages in addition to their native language: French, German, Russian, or a language approved by petition to the field.

In addition to the two examinations required by the Graduate School, a Ph.D. degree candidate may be asked to take a qualifying examination.

Awards restricted to M.S. and Ph.D. candidates majoring in this field are: the John McMullen Graduate Fellowship, and the Edgar J. Meyer Scholarship.

Mechanical Design

This area is concerned broadly with the design, analysis, and manufacture of devices, machines, and systems. At Cornell the common theme of research and instruction is the application of analytical models, computer simulation, and experiment to significant practical problems. Laboratories with a wide range of general and special purpose equipment are supplemented by digital and analog computer facilities.

Thermal Power

Research and instruction are directed toward the study of energy: its transformation, transport, utilization, and the associated environmental interactions. Laboratories equipped with modern and sophisticated instrumentation are available for experimental work. A nuclear reactor facility as well as digital and analog computer services are provided for student use.

Thermal Processes

Research areas include basic fluid dynamics, stability of fluid motion, turbulence, geophysical fluid dynamics, wave motions, numerical studies, and environmental fluid mechanics. Among current research programs in heat transfer are natural convection flows, heat and mass transfer in biological cells, heat rejection to the environment, and boiling and radiative heat transfer. Combustion studies now in progress involve chemical kinetics, turbulence, fire spread, and the generation of pollutants. Laboratory facilities include a Mach-Zehnder interferometer, a solar furnace, an environmental wind tunnel, devices for measuring secondary flows, hot-wire anemometers, laser doppler anemometers, shock tubes, and a minicomputing system.

Materials Processing

Current and recent research areas include the mechanism of friction welding, friction and wear, thermal fracture of cutting tool materials, and computer-aided design and manufacture of molds for injection molding. Facilities include an extensive laboratory of machine tools and gages, as well as specialized equipment and instrumentation for the study of fundamentals of traditional and nontraditional manufacturing processes.

Professional Degree

The degree of Master of Engineering (Mechanical) is a curricular type of professional degree, the general requirements for which are stated in *Graduate Study in Engineering and Applied Science at Cornell.* The program permits emphasis on a particular area, such as: machine dynamics and control, mechanical analysis and development, vehicles and propulsion, propulsion engines, thermal environment, thermal power, transport processes, fluid mechanics, manufacturing engineering, and material removal.

Faculty and Specializations

Mechanical Design and Materials Processing

Biomechanics, vehicle dynamics, finite elements, hydrodynamic lubrication, mechanical shock and vibration, control systems, computer-aided product design, optimization, reliability, manufacturing processes: D. L. Bartel, J. F. Booker, S. Jahanmir, R. M. Phelan, S. L. Phoenix, D. L. Taylor, K. K. Wang, R. L. Wehe

Thermal Power

Energy conversion, combustion engines, combustion product control, environment control, fuel uses and transformations, power systems, propulsion, and turbomachinery: B. Conta, P. C. T. de Boer, F. C. Gouldin, W. McLean, F. K. Moore, E. L. Resler, Jr., D. G. Shepherd

Thermal Processes

Transport and fluid dynamics, including stability, buoyancy-induced flows, combustion, radiative and nonequilibrium flows, turbulence, geophysical fluid dynamics, diffusion in biological systems, thermal and chemical pollution: A. R. George, F. C. Gouldin, S. Leibovich, R. L. Levin, J. L. Lumley, W. McLean, F. K. Moore, P. Radulovic, K. E. Torrance, Z. Warhaft

Heat transfer and thermodynamics, including convective flows, heat rejection systems, heat transfer in structures, applications of cryogenics to biological systems, classical, statistical and irreversible thermodynamics: B. Conta, P. C. T. de Boer, R. L. Levin, F. K. Moore, P. Radulovic, E. L. Resler, K. E. Torrance

Medical Sciences (Graduate School of Medical Sciences)

Requests for information regarding the fields in the medical sciences should be addressed to Professor Julian R. Rachele, Acting Dean, Graduate School of Medical Sciences, Cornell University Medical College, 1300 York Avenue, New York, N.Y. 10021. (See also p. 15 of this *Announcement.*)

Biochemistry

Research opportunities are offered in areas such as: enzymology; mechanism of enzyme action; intermediary metabolism; physical chemistry and structure of proteins, nucleic acids, and other

macromolecules; neurochemistry; hormone chemistry and action; molecular biology; synthesis and biochemical action of chemotherapeutic compounds. The field also offers advanced courses and seminars on the chemistry and biochemistry of carbohydrates, lipids, nucleic acids, and proteins, and on the methodology of physical biochemistry.

Biological Structure and Cell Biology

Graduate study in this field emphasizes the basic relationships between structure and function of biological systems at all levels of organization. The field is fundamentally concerned with the nature, development, and functional modulation and with significance of configuration, pattern, and other spatial relationships in biological systems. The scope of interest extends from the molecular level to that of the whole organism and embraces normal as well as pathological structure.

Biology

The program in biology at the Sloan-Kettering Division of the Graduate School of Medical Sciences is oriented toward an understanding of factors that initiate, control, and modify growth and biological development. Opportunity is offered for advanced work and research in cell biology, cytology, genetics, immunology, microbiology, pharmacology, and virology.

Biomathematics

A flexible program of applied mathematics in biology is offered to students whose primary interests are mathematical or theoretical, but who wish to concentrate on biological applications.

Biophysics

The opportunity for graduate work toward both the Ph.D. degree in the Field of Biophysics and the M.S. degree in the Field of Radiation Physics is offered at the Sloan-Kettering Division of the Graduate School of Medical Sciences. Active research programs are being conducted in fundamental radiation biophysics, including cellular radiobiology, and in the biophysics of membrane transport.

Genetics

Opportunities are available in several different areas including cytogenetics, human biochemical and cell genetics, mammalian developmental genetics, microbial genetics, nucleic acid chemistry and biochemistry, and virology.

Microbiology

This widely diversified field draws on faculty and facilities of the Medical School and the Sloan-Kettering Institute. Courses and thesis research are available in general and medical bacteriology, microbial chemistry and physiology, virology, immunology, genetics, and mycology.

Neurobiology and Behavior

The field offers an integrated multidisciplinary approach with emphasis on neurochemistry, neurophysiology, and neuropsychology and perception. Special facilities are available for research with humans and with experimental primates.

Pathology

Through the study of the disciplines of anatomic and clinical pathology, and in learning modern techniques of biologic investigation, the graduate program in pathology provides the student with a basic knowledge of disease processes. The student completing this program will have both the information and the technical skills to make significant inquiries into the nature of disease processes and to bridge the gap between classical, descriptive pathology, and such disciplines as biochemistry and molecular biology.

Pharmacology

Opportunities for thesis research include the influence of drugs and chemicals on biochemical systems; the peripheral, autonomic and voluntary nervous systems; the central nervous systems, the cardiovascular system, the kidney; and the relationship between chemical structure and biological activity.

Physiology

Facilities are available for studies of function in intact animals, whole organs, subunits of organs, isolated cells, and subcellular systems.

Medieval Studies

Graduate Faculty Representative: Arthur Groos, 172 Goldwin Smith Hall

Major Subject: Medieval Studies (medieval art, medieval history, medieval literature, medieval music, medieval philology, medieval philosophy)

Minor Subjects: Medieval Art, Medieval History, Medieval Literature (English, German, Latin, Old Norse, Romance, Semitic, Slavic), Medieval Music, Medieval Philology (Celtic, Germanic, Latin, Romance, Semitic, Slavic), Medieval Philosophy

The aim of this field is to allow the student to concentrate more fully upon medieval studies than is possible within the programs of other fields.

Although certain requirements are absolute (such as reading knowledge of Latin and a course in paleography and research methods), emphasis is on the formulation of individual programs to fit individual interests and needs. Teaching experience is a requirement for all Ph.D. degree candidates.

A broad undergraduate major in one of the participating disciplines ideally should precede graduate concentration in this field. All applicants are strongly urged to take the Graduate Record Examinations Aptitude Test and an appropriate Advanced Test, if such exists.

For the M.A. degree, proficiency in Latin and either French or German is required; for the Ph.D. degree, proficiency in Latin, French, and German.

Further information concerning the Field of Medieval Studies is to be found in the field's brochure, which can be obtained by writing to the graduate faculty representative.

Faculty and Specializations

B. B. Adams: medieval drama
F. M. Ahl: late Latin epic
A. J. Berger: Icelandic language and literature
V. T. Bjarnar: Icelandic language and literature
R. G. Calkins: medieval art and architecture
A. M. Colby: Old French language and literature
R. T. Farrell: Old English language and literature; English philology; medieval archaeology
C. Gilbert: medieval and Renaissance art
A. B. Groos: medieval German language and literature
T. D. Hill: Old English language and literature
J. J. John: Latin paleography; medieval history
R. E. Kaske: Middle English language and literature
N. Kretzmann: medieval philosophy
G. F. Mazzotta: medieval Italian language and literature
G. M. Messing: medieval Latin language and literature
C. Morón-Arroyo: medieval Spanish language and literature
J. M. Najemy: late medieval Italian and Renaissance history
B. Netanyahu: medieval Spanish and Jewish history
J. O'Donnell: late Latin; early Christian thought
D. M. Randel: medieval music
B. Tierney: medieval history; canon law
F. van Coetsem: Germanic philology
J. F. Vigorita: medieval Celtic languages and literature
W. Wetherbee III: medieval Latin and Middle English language and literature; Arthurian literature

Microbiology

Graduate Faculty Representative: H. W. Seeley, Jr., 405 Stocking Hall

Major and Minor Subject: Microbiology (See also the Field of Veterinary Medicine.)

Applicants should have preparation in general chemistry at an intermediate level, organic chemistry, physics, and introductory courses in the biological sciences. In addition, training in physical chemistry and calculus is desirable.

While deficiency in the subjects listed does not preclude admission, it may increase the time necessary to earn a degree.

Applicants are required to submit scores for the Graduate Record Examinations Aptitude Test.

One semester or more of teaching is required of all graduate students. Well-equipped laboratories are available. Staff research interests include virology, genetics, physiology, biochemistry, molecular biology, systematic and environmental microbiology, and microbial ecology.

Faculty and Specializations

Animal virology: L. E. Carmichael, J. H. Gillespie
Aquatic microbiology: M. Alexander, N. C. Dondero, H. W. Seeley, Jr.
Food microbiology: D. F. Splittstoesser*, J. R. Stamer* K. H. Steinkraus*, P. J. VanDemark
Industrial fermentations and bioengineering: R. K. Finn, M. L. Shuler, K. H. Steinkraus*
Metabolic control: J. Gibson, P. J. VanDemark, S. A. Zahler
Microbial ecology: M. Alexander, E. A. Delwiche, J. Gibson, R. E. MacDonald, H. W. Seeley, Jr.
Microbial genetics: S. A. Zahler
Microbial nutrition: P. J. VanDemark
Microbial physiology: E. A. Delwiche, J. Gibson, H. W. Seeley, Jr., P. J. VanDemark
Microbiology of wastes: N. C. Dondero
Molecular biology: R. E. MacDonald
Procaryote photosynthesis: J. Gibson
Soil microbiology: M. Alexander

Music

Graduate Faculty Representative: James Webster, 113 Lincoln Hall

Major and Minor Subjects: Musical Composition, Musical Performance (minor only for the M.F.A. and D.M.A.), Musicology, Theory of Music

In musicology the M.A. and Ph.D. degrees are conferred; in composition, the Master of Fine Arts (M.F.A.) and Doctor of Musical Arts (D.M.A.); and in music theory, the M.A.

All applicants must take a test of musicianship, as well as a written music history and analysis examination. Sample copies of the test and further information may be obtained from the office of the Department of Music. Applicants must also submit scores of the Graduate Record Examinations Aptitude Test (the GRE Achievement Test in music is optional), and a term paper or musical composition.

For the M.F.A., the D.M.A., and the M.A. in theory, the field requires a reading knowledge of French or German; for the M.A. in musicology and the Ph.D., a reading knowledge of both is required.

The Program and Facilities

The graduate program at Cornell coordinates musical composition, scholarship, and performance. Students create individual programs of study in accordance with their interests and abilities under the supervision of their Special Committees. While mastering a professional discipline, they are expected to continue to develop broad interests in music and related fields. Doctoral studies in musicology may emphasize music theory or ethnomusicology. The performers in the field specialize in historically authentic performance practice.

The Music Library, housed in Lincoln Hall, has an excellent collection of the standard research tools; its holdings consist of approximately 50,000 books and

* Faculty of the New York State Agricultural Experiment Station at Geneva

scores and 15,000 records. Particularly noteworthy are the collections of opera scores from all periods, twentieth-century scores and recordings, and a large microfilm collection of Renaissance sources, both theoretical and musical. In addition, the Department of Rare Books in Olin Library contains an important collection of early printed books on music and musical manuscripts.

The Verne S. Swan collection of about thirty musical instruments is especially rich in old stringed instruments. A small Challis harpsichord and clavichord are available for practice; a Hubbard harpsichord is reserved for concerts. There is an Aeolian-Skinner organ in Sage Chapel, a Schlicker organ at Barnes Hall, and a Hellmuth Wolff organ in Anabel Taylor Chapel. A studio for electronic music was built in 1970.

The Department of Music and the Faculty Committee on Music sponsor more than eighty concerts each semester by world-renowned musicians, faculty members, and students.

Faculty and Specializations

W. Austin: history of twentieth-century music; nineteenth-century music in Russia and America; philosophy of music
M. Bilson: the fortepiano of the eighteenth and early nineteenth centuries; piano literature
J. Hsu: literature and technique of the viols and violoncello
K. Husa: composition; orchestration; conducting
S. Monosoff: violin; baroque violin; chamber music; performance practice
E. Murray: theory; twentieth-century music
R. Palmer: composition; general theory; theory of twentieth-century tonality
D. Randel: medieval and Renaissance music
T. Sokol: choral music; conducting; performance styles
J. Webster: eighteenth- and nineteenth-century music; theory of tonal music; history of theory
N. Zaslaw: seventeenth- and eighteenth-century music; performance practice

Also available for consultation are members of the Graduate Faculty in Music at the State University of New York at Binghamton, including:
E. Borroff: baroque music; American music
S. Chianis: ethnomusicology; organology
P. Friedheim: nineteenth- and early twentieth-century music
W. Klenz: baroque music; performance practice; music aesthetics
E. Laderman: composition
H. B. Lincoln: sixteenth-century music; computers in music research
J. Rothgeb: music theory; analysis

A brochure more fully describing the graduate programs in music can be obtained upon request to the graduate faculty representative.

Natural Resources

Graduate Faculty Representative: R. T. Oglesby, Fernow Hall

Major and Minor Subjects: Aquatic Science, Fishery Science, Wildlife Science, Natural Resources Conservation, Forest Conservation (minor subject only)

Applicants should be well prepared in biological sciences; a strong background in physical sciences and a working knowledge of statistical methods are highly desirable. To major in natural resources conservation, a student should have previous training in a discipline that can be used in focusing on natural resources problems; also, professional job experience is desirable.

An oral qualifying examination is given to Ph.D. candidates early in residence.

Research Facilities

A variety of terrestrial and aquatic environments is available for research. Within sixty miles of the campus are reforested areas, mature hardwood forests, extensive agricultural lands, wetlands, lakes, streams, and ponds.

Several forested or partially wooded areas are available for research, demonstration, and management purposes. Cornell's Arnot Teaching and Research Forest, eighteen miles from the campus, consists of 4,000 acres of second growth beech, birch, maple, hemlock, and associated native forest trees. The forest has populations of grouse, deer, and other wildlife, and contains ten ponds. Studies of plantation management and tree growth requirements have been conducted at the Arnot Forest for many years.

The Department of Natural Resources operates the Cornell University Biological Field Station, with 1½ miles of shoreline and 400 acres of land at Shackelton Point on Oneida Lake, a shallow, eighty-square mile eutrophic lake with about sixty warm water fish species. The Cornell Biological Field Station has a permanent research and maintenance staff. Facilities are available for short-term housing and research.

A Fishery Laboratory, located a half mile from the campus, contains facilities for instruction and research in fishery and aquatic science. The laboratory includes wet labs, an aquarium room and facilities for processing and holding fish, a radiation laboratory, a larval fish building, and a workshop. There are ten ponds on the laboratory grounds for research on warm water fishes in seminatural conditions. Boats are available for use in aquatic ecology and fishery studies on Cayuga Lake and the other Finger Lakes. Two well-equipped laboratories are available for limnological studies.

Certain wildlife research facilities are located one mile from the campus at the Richard E. Reynolds Game Farm of the New York State Department of Environmental Conservation. The Bio-Thermal Laboratory houses two thermal environment simulation tunnels, laboratory facilities for physiology, telemetry equipment, and equipment for nutritional analysis. Upland game birds are readily available for research at this facility. Several mouseproof enclosures for small mammal ecology and population studies are also located at the Game Farm.

The Resource Information Laboratory is located on the main campus and provides facilities for a variety of research concerning land use, resource inventories, and applications of remote sensing. The laboratory maintains a library of aerial photographs of the State of New York, supervises the service unit of the New York Land Use and Natural Resource Inventory, and has complete coverage of the ERTS-A and Skylab imagery of New York State and neighboring areas. Equipment and photographic processing facilities for use in interpreting remote sensing data are available for graduate research programs.

In addition, there are other nearby areas that the administering agencies have generously made available for special research, graduate study, and class demonstration. The 12,000-acre Connecticut Hill Game Management Area of the New York State Department of Environmental Conservation, twelve miles from Ithaca, is an outstanding grouse, deer, and woodcock area. A 3,200-acre state refuge at Howland's Island has been managed for waterfowl and other game since 1931; it is a useful study and demonstration area forty-five miles from the campus. The Montezuma National Wildlife Refuge of the U.S. Fish and Wildlife Service, forty miles away, is an outstanding waterfowl and muskrat management area.

Cooperative Research

The New York Cooperative Wildlife Research Unit is supported jointly by Cornell University, the New York State Department of Environmental Conservation, the U.S. Fish and Wildlife Service, and the Wildlife Management Institute. Its primary missions are to train graduate students in wildlife science and to conduct basic and applied research. This unit employs two full-time biologists. Current research projects are concerned with (1) ecology of wetlands, (2) small mammal population dynamics, (3) effects of fire on secondary succession, (4) mammalian reproduction, and (5) use of telemetry to study predation on waterfowl.

The New York Cooperative Fishery Research Unit was established at Cornell in 1963 to combine federal, state, and University assets to increase the facilities for advanced training and research in fishery biology. This unit employs two professors. Current research programs include studies on intensive culture of walleyes, causes of early mortality of freshwater fishes and management methods for minimizing adverse effects of early mortality, development of a flow-through culture system for daphnids, and the larval development of catostomid fishes. The unit also has strong interests in urban fishing management, the use of waste waters in aquaculture, and the use of hatchery-reared fish in warm-water fish management. The unit's assistant leader serves as director of the Cornell Aquaculture Program, a comprehensive program concerned not only with traditional methods of fish culture, but also methods and facilities for culturing additional species, disease problems, processing and marketing, water quality and effluent problems, fish genetics, and the nutrition of fishes.

Faculty and Specializations

R. A. Baer, Jr.: environmental values, land ethics
H. B. Brumsted: community and regional problems; environmental education, outdoor recreation; wildlife values, utilization, policies
T. J. Cade: behavior and ecology of birds
J. W. Caslick: wildlife-agriculture relationships; wildlife management
W. H. Everhart: population ecology of freshwater fish; environmental conservation and public problems of natural resource management
J. L. Forney: ecology of freshwater fish
R. J. Gutiérrez: ecology and evolution of birds
L. S. Hamilton: environmental resource analysis; multiple use of forest lands; ecological basis of land-use planning; international resource problems
E. E. Hardy: remote sensing and resource inventories
J. W. Kelley: environmental conservation and natural resource extension
J. P. Lassoie: nonindustrial uses of forest lands; woodlot management; forest ecology; tree physiology
R. A. Malecki: waterfowl biology and wetland ecosystems
R. J. McNeil: international resource problems; ethics, attitudes, values and life styles; big game ecology
A. N. Moen: physiology, nutrition, and behavior of free-ranging animals
R. R. Morrow: forest management and economics, particularly growth and valuation
J. G. Nickum: aquaculture, fishery resource management
R. T. Oglesby: comparative limnology and the management of lakes
M. E. Richmond: reproduction and population biology of mammals and birds; terrestrial ecology
C. L. Schofield: aquatic ecology; water chemistry
D. A. Webster: ecology and population dynamics of trout and salmon
B. T. Wilkins: natural resource policies; outdoor recreation
W. D. Youngs: dynamics of animal aggregates

Near Eastern Studies

Graduate Faculty Representative: D. I. Owen, 164 Rockefeller Hall

Major and Minor Subject: Near Eastern Studies

Near Eastern studies at Cornell are concerned especially with those Semitic languages and literatures in the orbit of whose users, molders, and creators there emerged the three world religions of Judaism, Christianity, and Islam.

The program is designed to help students acquaint themselves with the most fundamental elements of these languages and literatures and also to acquire a high degree of specialization in one or more areas of: (1) ancient Near Eastern and biblical studies; (2) ancient, medieval, and modern Jewish history; (3) ancient and medieval Arabic literature; and (4) Hebrew language and literature.

Candidates for the Ph.D. degree will be expected to demonstrate mastery in the language or languages of the main texts that will be directly related to the topic of their dissertations. Students are advised to determine early in their training the special field of their concentration and to consult their advisers re-

garding their linguistic requirements. All candidates majoring in the field will be expected to have at least three years of undergraduate study of one Semitic language or the equivalent before admission.

Before the end of the fourth term of graduate study, each Ph.D. candidate must demonstrate competence in reading scholarly materials in any two of the following languages: French, German, Italian, Latin, Russian, and Spanish. Candidates for the master's degree must demonstrate competence in one of these languages or in Greek, at least one term before the degree is awarded.

Faculty and Specializations

B. Netanyahu: Judaic studies; medieval and modern Jewish history and literature
D. I. Owen: Near Eastern languages, literature, history, and archaeology; history and archaeology of ancient Israel
M. Pelli: Hebrew language and literature; *Haskalah* ("Enlightenment")
I. Rabinowitz: biblical literature; Semitic languages
M. B. Schub: Arabic, Hebrew, and Ethiopic; comparative Semitics

Neurobiology and Behavior

(See also the listing under Medical Sciences.)

Graduate Faculty Representative: Miriam M. Salpeter, 148 Langmuir Laboratory

Major and Minor Subjects: Neurobiology (including neurophysiology, neurochemistry, neuropharmacology, sensory physiology, neuroanatomy, cellular and molecular neurobiology), Behavioral Biology (including ethology)

Applicants must present scores of the Graduate Record Examinations Aptitude Test and one of the advanced sciences tests. Students can be considered for Cornell fellowships, and teaching and research assistantships and traineeships in cellular and molecular neurobiology. Deadline for application to the field is February 15. Early application is recommended, and to be eligible for a Cornell fellowship applications are due by January 15. The field discourages the application of Cornell graduates and accepts students from Cornell only under special circumstances. (Please consult with the graduate faculty representative.)

The field has no language requirement, but such a requirement is frequently imposed by the student's Special Committee.

In addition to the normal requirements of the Graduate School, the field requires for the Ph.D. degree one year of teaching experience, a written qualifying examination at the end of the first year of study, and an orientation meeting with the Special Committee within the first three semesters at Cornell. The field also requires each student to give a publicly announced seminar as part of the thesis defense for both the M.S. and Ph.D. degrees.

Faculty and Specializations

Members of the faculty will be especially interested in directing research in the areas mentioned below. Prospective students may wish to correspond with staff members whose interests are most closely related to their own before they apply.

E. Adkins: vertebrate social behavior; hormonal and neural bases of reproductive and aggressive behavior
K. Adler: photoreception, orientation and circadian rhythms of vertebrates; behavior of amphibians and reptiles
R. Buskirk: social behavior, field studies
J. Camhi: behavioral neurophysiology of invertebrates
R. Capranica: animal communication; sensory neurophysiology
J. F. Cummings: comparative neurology and histology
A. de Lahunta: clinical neurology; neural pathology
W. C. Dilger: comparative ethology of vertebrates; behavioral evolution and ontogeny
G. C. Eickwort: arthropod behavior; evolution of social and nest-building behavior
T. Eisner: chemical communication; chemical ecology; insect behavior and physiology
S. T. Emlen: animal orientation systems; adaptive strategies of vertebrate social behavior
E. L. Gasteiger: electrical activity of the vertebrate nervous system; neural nets
P. W. Gilbert: biology of the elasmobranch fishes; functional vertebrate anatomy
B. Halpern: sensory physiology; chemoreception
H. C. Howland: sensory physiology; mathematical biology
R. R. Hoy: animal communication; behavior genetics of invertebrates; regeneration and development in invertebrate nervous systems
R. E. Johnson: vertebrate social behavior; olfaction and chemical communication in mammals; human ethology
W. T. Keeton: animal orientation and navigation, especially homing by birds; comparative behavior in evolutionary and systematic studies
M. Kim: neurophysiology; systems analysis
R. D. O'Brien: neuropharmacology; neurochemistry
T. R. Podleski: neurochemistry; membrane physiology
W. Roelofs: insect sex pheromones; identification and behavioral responses in the field and in the laboratory
M. Salpeter: neurocytology; synaptic mechanisms; neurotrophic phenomena; electron microscopy and EM autoradiography
D. N. Tapper: sensory physiology; receptor and central integration processes

Nuclear Science and Engineering

Graduate Faculty Representative: David D. Clark, 105 Ward Laboratory

Major and Minor Subjects: Nuclear Science, Nuclear Engineering

Nuclear science and engineering is concerned with the understanding, development, and application of the science of nuclear reactions and radiations. The graduate programs at Cornell allow specialization in basic nuclear science, in applied nuclear engineering, or in a combination of the two.

Three graduate degree programs are offered. The Master of Engineering (Nuclear) is a professional de-

gree; the Master of Science and Doctor of Philosophy degrees are intended for those who plan to pursue research or teaching careers.

A bachelor's degree in science or engineering, including one year of advanced calculus and a one-year course in atomic and nuclear physics, is required. Students with less preparation may be admitted but should expect to take longer to complete degree requirements. Applicants are urged but not required to submit Graduate Record Examinations scores.

Before the beginning of the second term of graduate study, the Ph.D. student is expected to form a Special Committee, which will then administer an informal oral examination designed to guide the future course of study.

For the Ph.D. degree, a reading knowledge of one language other than English is required.

Financial aid, including teaching or research assistantships, traineeships, fellowships, and loans is available to graduate students. For applications to the M.S. or Ph.D. program, no special fellowship forms are required. Applications for admission received by January 15 are reviewed for Cornell graduate fellowship awards. Other forms of award are generally considered at this time but may also be awarded as they become available at any time during the year.

Prospective students in the Master of Engineering (Nuclear) degree program who wish to apply for scholarship aid should obtain the appropriate form from the Chairperson, Graduate Professional Engineering Programs, 221 Carpenter Hall.

Research Opportunities

The M.S. and Ph.D. programs are oriented toward research and require completion of a thesis as well as course work. Candidates for one of these degrees choose either nuclear science or nuclear engineering as their major subject.

The programs also permit concentration in radiation protection or nuclear environmental engineering, as well as minors in areas such as plasma physics, fusion reactor engineering, and radiation damage.

Examples of current research in nuclear engineering include computer modeling of reactor systems for the investigation of operational, anticipated, and accident transients in liquid metal cooled fast breeder reactors and light water moderated reactors. Another example is the development of models for determining failure probability of reactor systems.

Research groups in nuclear science are currently pursuing studies of nuclear structure, interaction of radiation with matter, activation analysis, and radiation chemistry.

Current examples of nuclear structure research are experimental investigation of short-lived nuclear isomeric states—in particular the "shape isomers" associated with the fission barrier—using instrumentation invented and developed at Ward Laboratory.

In addition, synchrotron radiation studies of excitative and de-excitative processes in isolated atoms or atomic aggregates are being carried out at the Cornell 12 GeV electron synchroton and will be continued at the 8 GeV electron-positron storage ring currently under construction. Specific topics include: properties of highly ionized high Z contaminants of plasmas (e.g., Fe), destruction of molecules of biological interest by photons, and gas desorption from thermonuclear wall materials.

Experimental research is centered at the following facilities of the Ward Laboratory: (1) A TRIGA reactor, with a steady-state power of 100 kilowatts and a pulsing capability of up to 250 megawatts, for activation analysis and nuclear physics; (2) Cornell Critical Facility, a "zero power reactor" of very versatile design for basic studies in reactor physics and dynamics; (3) Gamma Cell, a shielded cell with a nominal 10,000-Curie Co^{60} gamma-ray source, for radiation chemistry and radiation damage studies; (4) 3 MV accelerator of high current capability for atomic and nuclear structure studies and high intensity monoenergetic neutron production.

Professional Degree

This two-term curricular program leading to the degree of Master of Engineering (Nuclear) is intended primarily for individuals who want a terminal professional degree, but it may also serve as preparation for doctoral study in nuclear science and engineering.

Further information may be obtained by writing to the nuclear science and engineering graduate faculty representative.

Faculty and Specializations

K. B. Cady: nuclear engineering; nuclear reactor safety; nuclear environmental engineering
A. P. Casarett: radiation biology
D. D. Clark: nuclear structure; radiation detection; energy conversion
H. H. Fleischmann: thermonuclear power; plasma physics
C. D. Gates: nuclear environmental engineering
B. L. Isacks: seismological aspects of nuclear power plant siting
V. O. Kostroun: interaction of radiation and matter; synchroton radiation studies of properties of materials; nuclear and atomic structure
C. Y. Li: fast neutron damage; nuclear materials
S. Linke: energy conversion
R. M. Littauer: nuclear instrumentation; pulse electronics
F. K. Moore: thermal engineering; energy conversion
G. H. Morrison: activation analysis
M. Nelkin: neutron scattering; transport and kinetic theory
J. S. Thorp: systems engineering; controls
R. L. Von Berg: radiation chemistry; chemical engineering

Nutrition

Graduate Faculty Representative: E. Elizabeth Hester, 373 Martha Van Rensselaer Hall

Major and Minor Subjects: Animal Nutrition, Human Nutrition, General Nutrition, Foods, International

Nutrition, Nutritional Biochemistry, Clinical Nutrition (M.N.S.)

Adequate background in chemistry, biology, physics, and mathematics is essential for advanced study in nutrition, particularly in areas involving laboratory experimentation. Some additional training in nutrition, food science, and microbiology is recommended. For areas of study relating to community aspects of nutrition, course experience in the social sciences is important. Entering students with background deficiencies can correct a limited number after they have been admitted to the graduate program.

Candidates for the M.S. degree must satisfy requirements in one major and one minor subject area. Candidates for the Ph.D. degree must satisfy requirements in one major and two minor subject areas; only one of the minor subjects may be selected from within the field. Candidates for the M.N.S. degree must complete a two-year program consisting of study at the University and affiliated clinical sites. All degree programs require a thesis; the specific requirements are determined by the Special Committee for each candidate.

Members of the faculty in various colleges and divisions of the University with interests in nutrition comprise the graduate faculty in the field. Graduate students may study with faculty in the Division of Nutritional Sciences, the College of Veterinary Medicine, the Departments of Animal Science or Poultry Science in the College of Agriculture and Life Sciences, or the Department of Food Science and Technology of the Geneva Experiment Station.

Research and Study Opportunities

Depending upon interests, a student may obtain training in many aspects of nutrition and in the biological and social sciences related to nutrition. Several combinations of majors and minors selected from all colleges or divisions of the University are possible, and both human and animal nutrition interests are accommodated within the field. For those preparing themselves for laboratory experimentaion in nutrition, physiology and biochemistry minors are usually recommended although other minors are frequently chosen. Students interested in community and international nutrition have access to active programs that provide opportunity for field experience in the United States or abroad. Students seeking training in foods have opportunity to apply principles and techniques of organic chemistry, biological science, and microbiology to problems dealing with human food. As a part of their training, graduate students may be expected to assist in teaching.

Faculty and Specializations

Research of the faculty encompasses many aspects of nutrition: metabolism of proteins and amino acids, vitamins, minerals, lipids, energy metabolism, gastrointestinal physiology, nutritional pathology, nutrition and behavior, community nutrition, international nutrition, food habits, dietetics, and nutrition education. Research is conducted with man, lower animals, and microorganisms as experimental models. Faculty of the field have ongoing research programs relating nutrition to man, as well as to laboratory animals, companion animals, and food producing animals. Faculty members grouped by general categories of their major interests are on the list which follows:

Human nutrition studies, including clinical, community, and international nutrition: T. C. Campbell, M. Devine, J. D. Haas, J. P. Habicht, M. C. Latham, D. A. Levitsky, M. A. Morrison, C. M. Olson, J. M. Rivers, D. A. Roe, D. M. Sanjur, R. Schwartz, V. Utermohlen, K. Visnyei

Nonruminant nutrition studies using experimental animals and nutritional biochemistry: R. E. Austic, A. Bensadoun, G. F. Combs, M. Devine, W. L. Dills, J. M. Elliot, L. R. Hackler, H. F. Hintz, D. E. Hogue, F. A. Kallfelz, H. G. Ketola, L. Krook, F. W. Lengemann, D. A. Levitsky, B. A. Lewis, D. B. McCormick, M. A. Morrison, M. C. Nesheim, W. G. Pond, J. T. Reid, J. M. Rivers, R. Schwartz, M. L. Scott, B. E. Sheffy, H. F. Travis, D. R. Van Campen, R. G. Warner, R. H. Wasserman, L. D. Wright, R. J. Young, D. Zilversmit

Ruminant nutrition studies: L. E. Chase, C. E. Coppock, J. M. Elliot, D. E. Hogue, L. Krook, F. W. Lengemann, W. G. Merrill, J. T. Reid, J. Van Soest, R. G. Warner

Foods: G. Armbruster, L. R. Hackler, E. E. Hester, B. Lewis, N. Mondy, D. M. Sanjur

Operations Research

Graduate Faculty Representative: Narahari U. Prabhu, 338 Upson Hall

Major and Minor Subjects: Operations Research, Applied Probability and Statistics, Systems Analysis and Design, Industrial Engineering, Information Processing

Appropriate Minor Subjects

The following minor subjects in other fields have been chosen most frequently in recent years: applied mathematics (Applied Mathematics), computer science (Computer Science), econometrics and economic statistics (Economics), environmental systems engineering (Civil and Environmental Engineering), managerial economics (Business and Public Administration), mathematics (Mathematics), planning theory and systems analysis (City and Regional Planning), and water resources (Water Resources)

Applicants must hold a bachelor's degree in engineering, mathematics, economics, or the physical sciences. Submission of the results of the Graduate Record Examinations is essential for fellowship and assistantship applicants.

A student in a Ph.D. program must demonstrate reading ability in French, German, Russian, or a language approved by petition to the field.

In addition to the examinations required by the Graduate School, the field requires a qualifying examination for Ph.D. candidates; this examination is normally taken at the end of the third term of graduate study at Cornell.

The John McMullen Graduate Fellowship is specifically designated for incoming candidates in this field.

Further information may be obtained by writing to the graduate faculty representative.

Professional Degree

The main objectives of the program leading to the professional degree of Master of Engineering (OR & IE) are to give each student greater breadth and depth of technical knowledge and to provide an environment in which he or she can synthesize the material studied in the course work. The emphasis is on mathematical modeling and the application of quantitative techniques associated with optimization, probability, and statistics to the design and operation of systems.

Students are required to complete an engineering project in which they have the opportunity to work closely with practicing engineers or analysts as well as Cornell faculty members. The projects are usually provided and sponsored by industrial or government organizations. Students are expected to perform all aspects of the project work, from problem formulation to communication of the results.

Subject Descriptions

Operations Research. The problem areas and techniques of operations research are approached from a highly analytical viewpoint. Emphasis is placed on constructing appropriate mathematical models to represent various real-life operational systems, and on developing techniques for analyzing the performance of these models. In this way procedures with desirable properties for dealing with such systems are developed. Queuing, inventory, reliability, replacement, and scheduling theories and simulation are employed. Optimization techniques such as mathematical programming (linear, nonlinear, and probabilistic), network flows, combinatorics, and dynamic programming are also used extensively, as are the various techniques of the mathematical theory of games.

Operations research students pursue courses of study and research that emphasize the use of the mathematical, probabilistic, statistical, and computational sciences in the development of the techniques of operations research. Their ultimate goals may range from making fundamental contributions to the techniques of operations research to applying these techniques to problems in diverse professional fields.

Applied Probability and Statistics This subject of study and research is designed for students having primary interests in the techniques and associated underlying theory of probability and statistics, particularly as they are applied to problems arising in science and engineering. The techniques emphasized are those associated with applied stochastic processes (for example, queuing theory, traffic theory, inventory theory, and time-series analysis) and statistics (including statistical decision theory; the statistical aspects of the design, analysis, and interpretation of experiments, and of ranking and selection theory; reliability theory; statistical quality control; sampling inspection; and acceptance sampling).

Students who elect work in this area are expected to acquire considerable knowledge of the theory of probability and statistics. All students who major in applied probability and statistics are required to minor in mathematics.

Systems Analysis and Design Although the solution of systems problems requires knowledge of underlying theory, the inherent practical limitations of the problem must be understood. Analysis of a system alone is insufficient; alternative solutions must be generated before selecting the one which can best be integrated with other elements of the system. Modeling concepts are equally important, but only when they can produce workable systems. Illustrations of the design of integrated systems can be found in industry, the environment, commerce, and government. A good example is the design of urban traffic control systems. Research activity may involve the development of new methodology or the synthesizing of new combinations from what is already known. The goal is to improve the understanding of systems or to develop new decision criteria for systems.

Industrial Engineering Studies of the analysis and design of the complex operational systems that occur in industry, particularly in manufacturing, are included in this subject. Plant design, cost analysis and control, and production planning are some of the major topics.

A student is expected to have considerable facility in the modern analytical techniques associated with rational decision making and the establishment of valid design criteria. These techniques are drawn from among inventory theory, queuing theory, mathematical programming, quality control, reliability theory, and computer simulation.

Because the design and operation of modern engineering systems apply to areas other than manufacturing, the use of the word "industrial" should not be considered restrictive. Industrial engineers frequently are employed as systems specialists in commerce, banking, distribution, merchandising, and hospital management.

Information Processing This subject deals with the design of data systems for the control of complex organizations. It is also concerned with analytical research in the fundamental techniques and problems that underlie such systems—such as questions of file organization, retrieval languages, scheduling of concurrent processes, deadlock and interference, and security and surveillance. Study in this area is administered in close cooperation with the Department of Computer Science (which is also housed in Upson Hall). Students are expected to minor in Computer Science and take substantial coursework in that field. The principal campus computing facility is an IBM 370/168. A satellite computer, directly connected to the 370/168, is located in Upson Hall. Typewriter terminals are also employed.

Faculty and Specializations

R. E. Bechhofer: engineering statistics; design of experiments; ranking and selection procedures; biomedical statistics
L. J. Billera: game theory; combinatorics
R. W. Conway: information processing systems; computer science

J. E. Dennis: optimization
D. C. Heath: applied probability; stochastic processes
J. C. Kiefer: statistical decision theory; optimum experimental design; sequential analysis
W. F. Lucas: game theory; combinatorial analysis; graph theory
W. R. Lynn: environmental systems
W. L. Maxwell: information processing systems; production control; systems simulation
J. A. Muckstadt: industrial systems; inventory theory; industrial systems analysis
G. L. Nemhauser: mathematical programming; operations research
N. U. Prabhu: stochastic processes; queuing theory; storage theory
T. J. Santner: statistics; ranking and selection procedures; biomedical statistics
B. W. Saunders: facility design; materials handling; manufacturing design
L. W. Schruben: simulation; operations research; health systems
A. Schultz, Jr.: operations research; systems analysis
F. L. Spitzer: probability theory
M. S. Taqqu: applied probability
H. M. Taylor III: applied probability
M. J. Todd: mathematical programming; operations research
L. E. Trotter, Jr.: mathematical programming; operations research
B. W. Turnbull: statistics; reliability theory; biomedical statistics
L. I. Weiss: statistical decision theory; sequential analysis; nonparametric statistics

Philosophy

Graduate Faculty Representative: Allen Wood, 218 Goldwin Smith Hall

Major and Minor Subjects: Philosophy (For areas of concentration see list of Faculty and Specializations.)

The Susan Linn Sage School of Philosophy, which comprises the Field of Philosophy in the Graduate School, was founded through the generosity of Henry W. Sage. There are at present twelve faculty members engaged in full-time instruction. The faculty manages and edits the *Philosophical Review*.

A background in philosophy equivalent to a Cornell undergraduate major is presupposed, and deficiencies must be made up in addition to graduate work. The Field of Philosophy has no terminal M.A. program, but under exceptional circumstances the field has accepted M.A. students.

A student whose major interest is in philosophy is required (a) to gain a general knowledge of the whole subject including its history, and (b) to select some aspect or subdivision of it for intensive study and research.

A doctoral candidate normally spends two years taking courses (usually three courses or seminars each semester) and preparing for the admission to candidacy examination, after which work on the thesis begins. There are no field-wide course requirements. Each student's program of study is worked out individually in regular meetings each semester with his or her three-person Special Committee. There are no written comprehensive examinations. The admission to candidacy examination is an oral examination on the student's thesis proposal and related subjects.

The field requires teaching experience for all Ph.D. candidates.

The meetings of the Philosophy Discussion Club are among the outstanding features of the program. Every fortnight the club meets to hear and discuss a paper by one of its members or a visiting scholar. A number of distinguished philosophers visit the club each year.

Joint Program in Ancient Philosophy with the Field of Classics

The object of the joint program is to meet the demand for scholars of ancient philosophy who are competent in both philosophy and Classics.

The course requirements include two graduate-level courses in Classics and two graduate-level courses in philosophy.

Participants should have had three years of Greek upon admission, or should pass a sight-reading test in Greek after one semester.

Faculty and Specializations

R. Boyd: philosophy of science; philosophy of psychology; philosophy of social science; logic; philosophy of mathematics
G. Fine: ancient philosophy; Descartes; the empiricists; epistemology
C. Ginet: metaphysics; epistemology; philosophy of mind; philosophy of language
T. Irwin: ancient philosophy; moral and political philosophy; Kant; the empiricists
N. Kretzmann: history of philosophy and logic; medievil philosophy and logic; ancient philosophy and logic; philosophy of religion
D. B. Lyons: moral, political, and legal philosophy
N. Malcolm: epistemology; philosophy of mind; Descartes; Leibniz; Moore; Wittgenstein
R. Miller: social and political philosophy; Marx; epistemology; aesthetics; Wittgenstein; philosophy of mind
S. Shoemaker: metaphysics; philosophy of mind; history of modern philosophy; epistemology
R. Stalnaker: philosophy of language; metaphysics; philosophy of logic
N. Sturgeon: history of modern philosophy; ethics
A. Wood: modern Continental philosophy; history of modern philosophy; social and political philosophy; philosophy of religion

Physics

Graduate Faculty Representative: John D. Reppy, 532-A Clark Hall

Major and Minor Subjects: Physics, Experimental Physics, Theoretical Physics

The graduate physics program at Cornell is designed to give students an adequate background in the con-

cepts and techniques of both theoretical and experimental physics to prepare them for careers at the most advanced level in research or teaching. Although the program focuses on the Ph.D. degree, there is a wide variety of options available to students during their work at Cornell, both in the final level of achievement and in the area of concentration.

The large majority of entering students have completed an undergraduate physics major program including such courses as analytical mechanics, electricity and magnetism, optics and wave motion, electronics, and atomic physics; some advanced undergraduate laboratory work in physics is also expected. Knowledge of differential equations and of vector calculus is essential.

In the selection of new students, emphasis is on the quality of the undergraduate work and on the promise for graduate work rather than on the extent of undergraduate study in physics and related subjects. Many entering students enroll in one or more undergraduate courses to make up deficiencies.

No foreign language is required either for admission or for a master's or a Ph.D. degree, but proficiency in at least one foreign language is very desirable.

A copy of the brochure, *Graduate Study in Physics at Cornell,* containing a more detailed description of the program, may be obtained by writing to the graduate faculty representative.

Research and Study Opportunities

Theoretical Physics Many-body theory, theory of superconductors, theory of metallic state, superfluidity, statistical mechanics and irreversibility, phonon physics and transport processes, low-temperature physics, computer simulation of classical and quantum many-body systems, plasma physics, applications of the renormalization group to field theory and critical phenomena, dispersion relations and strong interactions, internal symmetries and their connection with strong interaction dynamics, algebra of currents, quantum electrodynamics, unified weak and electromagnetic interactions, high-energy electromagnetic interactions, astrophysics, stellar structure.

Experimental High-Energy Elementary Particle Research During the last ten years, the Laboratory of Nuclear Studies has operated a 12 GeV electron synchrotron and conducted an experimental program of photoproduction in elastic and inelastic scattering of electrons and photons. This program is currently being terminated and the facility is being modified to provide an electron-positron storage ring for colliding beam experiments. The new facility, CESR, will work with beam energies up to 8 GeV. First colliding beams are planned in the fall of 1979. A large magnetic analyzing detector is being constructed for the interaction region to search for and examine new states of matter, such as quarks; to study energy level systems of these subatomic particles; to study hadronic final states, weak interactions, photon-photon collisions, and high-energy tests of the theory of quantum electrodynamics. A large on-line computer is used to process the data, and an electronics shop provides support for the laboratory. Two separate research programs are also being conducted by faculty members at the 500 GeV proton synchrotron at the Fermi National Accelerator Laboratory.

Experimental Condensed Matter Physics Transport properties of metals including scattering rate anisotropy, nuclear magnetic resonance studies of atomic motion in solids and of electronic structure, Raman scattering in magnetic and in biological systems, nonlinear laser spectroscopy, time-resolved optical spectroscopy, phonon physics, thermal and transport properties of insulators, properties of solid and liquid ^{3}He and ^{4}He, particularly superfluid properties, magnetic polymers, metallo-organic compounds, far infrared spectroscopy, optical properties of composite media with possible solar energy applications, and electron spin resonance in metals and insulators.

Faculty

V. Ambegaokar, N. W. Ashcroft, K. Berkelman, R. Bowers, D. G. Cassel, G. V. Chester, R. M. Cotts, J. W. DeWire, M. E. Fisher, D. B. Fitchen, B. Gittelman, K. Gottfried, K. I. Greisen, L. N. Hand, D. L. Hartill, P. L. Hartman, D. F. Holcomb, T. Kinoshita, J. B. Kogut, J. A. Krumhansl, D. M. Lee, R. M. Littauer, H. Mahr, B. D. McDaniel, N. D. Mermin, N. B. Mistry, H. F. Newhall, J. Orear, R. O. Pohl, J. D. Reppy, R. C. Richardson, E. E. Salpeter, J. C. Scott, R. H. Siemann, A. J. Sievers, R. H. Silsbee, A. Silverman, P. C. Stein, R. M. Talman, S. A. Teukolsky, M. Tigner, W. W. Webb, D. H. White, J. W. Wilkins, K. G. Wilson, W. M. Woodward, T. M. Yan, D. R. Yennie

Closely associated with the graduate program in physics are a number of faculty members in related fields who teach in the graduate courses in physics or serve as thesis advisers to physics students. There are also typically several visiting professors and about forty Ph.D. instructors and research associates who rarely serve on Special Committees but with whom the students may work informally.

Physiology

(See also the listing under Medical Sciences.)

Graduate Faculty Representative: T. Richard Houpt, Physiology Research Annex, Veterinary Medicine

Major and Minor Subject: Physiology (cellular physiology, comparative physiology, endocrinology and reproductive physiology, physical biology, vertebrate physiology)

See also listing under special interests of the faculty for major area subjects. Minors may be selected from such areas as biochemistry, biometry, chemistry, ecology, electrical engineering, genetics, histology, microbiology, nutrition, pathology, physics, and psychology.

All applicants should submit the results of the Graduate Record Examinations Aptitude and Advanced Biology Tests. Preparation should include a good

knowledge of biology, chemistry, biochemistry, and physics. Calculus, statistics, and genetics are also advisable.

The field requires that doctoral candidates pass a qualifying examination, taken before two residence units have been earned, and that each candidate teach two semesters unless the Special Committee deems it inadvisable or inappropriate.

All students admitted to the Ph.D. program in this field must take a written examination as part of the admission to candidacy examination. All students minoring in physiology must take a comparable examination. The written examination will be given twice a year, once in the fall and once in the spring.

Each Ph.D. student will be required to present a seminar, open to the faculty and graduate students of the field, on the thesis work after all laboratory work is essentially complete but before the written thesis is in final form.

A doctoral candidate in physiology must have two minor subjects. At least one of the minor committee members must not be a member of the Field of Physiology.

Faculty and Specializations

Prospective students are urged to correspond with professors in the list below whose interests are nearest their own.

Behavioral physiology: R. H. Foote, P. W. Gilbert, T. R. Houpt, H. C. Howland
Biochemistry, membrane structure: W. J. Arion, G. Lust
Cardiovascular physiology: E. N. Bergman, A. Dobson, A. F. Sellers
Comparative neurology and neuropharmacology: M. M. Salpeter
Comparative and environmental physiology: J. W. Hudson, W. N. McFarland, F. H. Pough
Endocrinology: W. R. Butler, R. A. Corradino, R. H. Foote, W. Hansel, A. van Tienhoven
Enzymology: J. F. Wootton
Gastrointestinal physiology: A. Bensadoun, R. A. Corradino, A. Dobson, T. R. Houpt, A. F. Sellers, C. E. Stevens, R. H. Wasserman
Herpetology: F. H. Pough
Histology, cytology, and electron microscopy: M. M. Salpeter, W. A. Wimsatt
Lactation: R. C. Gorewit, F. W. Lengemann
Lipid transport and metabolism: A. Bensadoun
Metabolism: E. N. Bergman, T. R. Houpt, F. W. Lengemann
Neurophysiology: E. L. Gasteiger, P. W. Gilbert, B. Halpern, D. N. Tapper
Pathological physiology: G. Lust, H. F. Schryver
Pharmacology and toxicology: A. L. Aronson
Radiation biology and physical biology: A. P. Casarett, F. W. Lengemann, R. H. Wasserman
Reproduction: W. R. Butler, A. P. Casarett, R. H. Foote, P. W. Gilbert, W. Hansel, N. L. Van Demark, A. van Tienhoven, W. A. Wimsatt
Ruminant physiology: E. N. Bergman, A. Dobson, A. F. Sellers, C. E. Stevens
Sensory physiology: B. Halpern
Vertebrate physiology: P. W. Gilbert, T. R. Houpt, A. F. Sellers, W. A. Wimsatt

Plant Breeding and Biometry

Graduate Faculty Representative: Neal F. Jensen, 420 Bradfield Hall

Major and Minor Subjects: Plant Breeding, Biometry, Plant Genetics

Plant breeding and plant genetics cannot be a major-minor combination; however, genetics (Field of Genetics) may be a minor.

Applicants should be well grounded in the fundamentals of the natural sciences and should have had courses in advanced chemistry, biology, calculus, and physics. Students intending to major in biometry will find it to their advantage to have additional training in mathematics.

All students must pass an English proficiency examination.

Students interested in crop improvement through breeding and the genetics of higher plants may choose plant breeding or plant genetics as a major. Research may involve studies of breeding methods, application of genetic principles to breeding, and correlation of knowledge from other areas such as physiology, biochemistry, and statistics in attacks on problems of yield, quality, adaptability, and disease-insect resistance. Plant genetics generally involves research more specifically aimed towards the analysis of hereditary and evolutionary phenomena.

Students interested in the development and application of statistical and mathematical methods in biology may elect a biometry major. Research problems may be purely theoretical studies, computer simulation studies, novel statistical analyses of real data, or may involve a combination of these approaches to various topics, such as sampling and statistical inference, the design and analysis of experiments, statistical genetics, quantitative ecology, or epidemiology.

Students majoring in plant breeding or plant genetics will find it necessary to remain in Ithaca during the summer or to make arrangements elsewhere for growing and studying the material used in connection with their research problems. Special provisions are made for students interested in international or extension experience.

Faculty and Specializations

Members of the staff are especially interested in directing research in the areas listed below, although research will not be limited to those areas. Staff listed under plant breeding direct thesis research on the crop plants with which they are primarily concerned. Staff listed under biometry direct theses on various aspects of statistical and mathematical genetics.

Biometry
F. B. Cady: design and analysis of experiments
W. T. Federer: statistics and experimental design
T. D. Mount: economic statistics
D. S. Robson: statistics and biometry
S. R. Searle: statistics and computing
D. L. Solomon: statistics and biomathematics

Plant Breeding
R. E. Anderson: golden nematode resistance in potatoes
R. S. Chaleff: plant cell genetics
L. V. Crowder: plant genetics; international agriculture
H. L. Everett: corn
V. E. Gracen: genetics and biochemistry of insect and disease resistance
P. Gregory: biochemistry of plant breeding
N. F. Jensen: small grains
C. C. Lowe: forage crops
H. M. Munger: vegetable crops
R. P. Murphy: forage crops
W. D. Pardee: extension and seed production
R. L. Plaisted: potatoes
D. H. Wallace: vegetable crops

At the New York State Agricultural Experiment Station in Geneva
D. W. Barton: vegetable breeding
M. H. Dickson: vegetable breeding
R. C. Lamb: fruit breeding
G. A. Marx: vegetable breeding
D. K. Ourecky: small fruit breeding
R. M. Pool: grape breeding
R. D. Way: apple breeding

Plant Pathology

Graduate Faculty Representative: O. C. Yoder, 356 Plant Science Building

Major and Minor Subjects: Plant Pathology, Mycology

A student majoring in one of these subjects is generally advised not to minor in the other.

Broad training in the biological and physical sciences is essential; course work or experience in plant pathology is not required. The applicant must present scores on the Graduate Record Examinations Aptitude Test.

Every student majoring in plant pathology or mycology is expected to take an oral, or oral and written, qualifying examination within the first twelve months after registration, in addition to the examinations required by the Graduate School.

Excellent opportunities for study and research are offered in all phases of plant pathology and mycology. Summer field trips with staff members give students experience in diagnosing diseases and in observing up-to-date control practices. All students are expected to obtain teaching experience in plant pathology and to become familiar with extension techniques.

Students majoring in plant pathology may elect to specialize in a particular branch of plant pathology, such as bacteriology, epidemiology, nematology, physiology of disease, disease cytology, virology, and tropical plant pathology; or in a crop-oriented area, such as diseases of forage, fruit, ornamentals, potatoes, vegetables, shade trees and shrubs, small grains, corn, and turf grasses. Students electing a major in mycology may develop their research program in cytology, genetics, morphology, physiology, or taxonomy.

An outstanding mycological and plant pathological herbarium, superior library facilities, excellent controlled-environment facilities, and modern equipment are available.

Further information is given in the brochure *Graduate Study in Plant Pathology and Mycology at Cornell*, which may be obtained from the graduate faculty representative.

Faculty and Specializations

G. S. Abawi*: research—soil-borne pathogens, vegetable diseases, disease control
J. R. Aist: research and teaching—disease and fungal cytology, root diseases
H. S. Aldwinckle*: research—breeding, genetics, nature of resistance of fruit crops
P. A. Arneson: teaching—plant protection; research—soil-borne diseases of fruit trees
D. F. Bateman: teaching and research—disease and pathogen physiology
S. V. Beer: research—bacterial fruit and vegetable diseases, disease physiology
C. W. Boothroyd: teaching—general plant pathology; research—corn diseases, soil-borne pathogens
S. W. Braverman*: research—plant introductions, plant quarantine, disease resistance
B. B. Brodie: research—nematology, biology, ecology, pest management, breeding for resistance
R. C. Cetas (at Riverhead): research—vegetable and potato diseases, fungicides, breeding for resistance; extension—potato and vegetable diseases
R. S. Dickey: teaching and research—phytopathogenic bacteria
W. E. Fry: teaching and research—plant disease control, epidemiology, disease physiology
J. D. Gilpatrick*: research—fungal diseases of fruit trees, fungicides, pest management
G. E. Harman*: research—seed pathology, physiology of parasitism, resistance mechanisms, biological control
M. B. Harrison: teaching—nematology; research—etiology and control of diseases caused by nematodes on forage, turf, nursery, vegetable crops
R. K. Horst: extension and research—diseases of florist and ornamental plants
G. W. Hudler: extension—diseases of woody ornamentals
J. E. Hunter*: research—epidemiology and control of vegetable diseases
H. W. Israel: research and teaching—cytology of diseased plants
E. D. Jones: extension and research—diseases of potatoes, potato certification, foundation seed programs
R. P. Korf: teaching—mycology; research—taxonomy, morphology, biology, and phytogeography of fungi
J. W. Lorbeer: teaching—mycology; research—diseases of vegetables, soil-borne pathogens, fungal genetics, epidemiology
W. F. Mai: teaching—nematology; research—etiology and control of diseases caused by nematodes alone and in association with other soil organisms, nematode physiology, and taxonomy

* Faculty at the New York State Agricultural Experiment Station in Geneva

R. L. Millar: teaching—advanced plant pathology; research—physiology of infection, ecology, diseases of forage crops
P. E. Nelson: research—diseases of ornamental crops, pathological histology, biology and taxonomy of *Fusarium*
P. C. O'Brien: research—"golden nematode" on potatoes and cyst nematodes affecting other plant hosts
W. F. Rochow: research—virus diseases of cereal crops, aphid transmission of plant viruses
O. E. Schultz: extension—diseases of potatoes, grain, and forage crops
A. F. Sherf: extension—vegetable disease diagnosis and control
W. A. Sinclair: teaching, extension, and research—dendropathology
R. W. Smiley: research and extension—turfgrass diseases; research—root diseases of small grains
M. Szolnik:* research—fruit diseases, fungicides, aerial spraying, fruit tree phenology
H. D. Thurston: teaching and research—potato diseases, breeding for disease resistance, tropical plant diseases and control
H. D. VanEtten: research and teaching—disease and pathogen physiology
R. E. Wilkinson: research—diseases of vegetable crops and dry beans, disease resistance
O. C. Yoder: research—genetics and physiology of disease, postharvest diseases of vegetables
M. Zaitlin: teaching—plant virology; research—plant virus replication, physiology of virus disease

Pomology

Graduate Faculty Representative: Loyd E. Powell, Jr., 121 Plant Science Building

Major and Minor Subject: Pomology

Applicants to this field should have a sound background in the basic sciences and an interest in fruit plants, but need not have done their undergraduate work in horticulture. A knowledge of botanical and chemical subjects is necessary. During their graduate work students are expected to become well acquainted with the Field of Pomology and with other fields closely allied to their thesis problems. Students registered in the Ph.D. degree program must take a qualifying examination in addition to the examinations required by the Graduate School.

Cornell University has two Departments of Pomology; one on the main Ithaca campus and one on its Geneva campus (Pomology and Viticulture) fifty miles away at the New York State Agricultural Experiment Station. Members of these departments are currently engaged in a great variety of research projects concerning growth-regulating substances, postharvest physiology, mineral nutrition, cold hardiness, rest period, root initiation, rootstocks, fruit set and development, fruit breeding, plant pigments, plant water relations, photosynthesis, and general cultural practices. Students take their course work at Ithaca but may conduct thesis research at either Ithaca or Geneva.

* Faculty at the New York State Agricultural Experiment Station in Geneva.

Faculty and Specializations

At Ithaca
G. D. Blanpied: postharvest physiology
L. L. Creasy: physiology and biochemistry of plant phenolics
L. J. Edgerton: plant growth regulators and fruit tree physiology; abscission; cold hardiness
D. C. Elfving: fruit production and physiology; growth regulators; water relations
F. W. Liu: postharvest physiology; tropical and subtropical fruits
G. H. Oberly: mineral nulrition; soils; tree fruit production
L. E. Powell, Jr.: plant hormones; dormancy; hormonal aspects of fruit development; analytical techniques for hormones
J. P. Tomkins: cultural practices with small fruit crops and grapes

At Geneva
J. N. Cummins: resistant rootstock breeding, genetics and testing; high density systems; rooting studies; virus interactions
O. F. Curtis, Jr.: weed control; juvenility; apple fruit growth
C. G. Forshey: mineral nutrition; growth regulators; fruit tree physiology
W. J. Kender: air pollution effects
A. N. Lakso: orchard management, mechanical harvesting; environmental physiology
R. C. Lamb: breeding for disease resistance in apples and pears, and for cold resistance in peaches and apricots
D. K. Ourecky: small fruit breeding; cytogenetics; cytology
R. M. Pool: grape breeding; vine physiology
N. J. Shaulis: general viticulture, with emphasis on leaf environment as affected by training, spacing, and vine size; mechanization
R. D. Way: apple and cherry cultivar evaluation, breeding, and genetics

Psychology

Graduate Faculty Representative: Ulric Neisser, 220 Uris Hall.

Major and Minor Subjects: Comparative Psychology, Developmental Psychology, Differential Psychology and Psychological Tests, Experimental Psychology, Experimental Psychopathology, Mathematical Psychology, Personality and Social Psychology, Physiological Psychology, Psycholinguistics

Minor Subjects: General Psychology, History and Systems of Psychology

In addition to transcripts of their undergraduate record, two or three letters of recommendation, and a personal statement of interests, applicants must submit scores on the Graduate Record Examination (Verbal and Mathematical Aptitude) and the Miller Analogies Test. An undergraduate major in psychology is desirable but not required. Prior research experience is particularly desirable. Applicants may submit research reports or other specimens of their work if they wish. Candidates for a terminal master's degree

are not accepted. The normal closing date for applications is February 1. Individuals whose primary interests lie in clinical, counseling, industrial, or school psychology should not apply.

Each student develops an independent program of study in consultation with his or her Special Committee. The three primary members of the Special Committee must be chosen by the end of the first year; students are encouraged to select at least one member (not the chairperson) from a field other than psychology. The graduate faculty representative will appoint a fourth member, whose function is to ensure that the student obtains adequate breadth of training.

Certain requirements are established by the field, acting through an elected executive committee consisting of both faculty and students. These requirements are usually enforced by the Special Committees, although it is the Special Committee and not the field that has final authority over each student's course of study. The present requirements include: (1) a first-year review and annual meetings of the Special Committee to review the student's progress; (2) a research paper completed by the end of the second year, and an oral report of the research made to a meeting of students and faculty; (3) a one-year course in statistics and experimental design; (4) at least ten hours a week of supervised teaching experience for at least two semesters; (5) the examination for admission to candidacy, which should be taken by the end of the third year (a Graduate School requirement); (6) a written dissertation proposal, which must be accepted at a meeting of the Special Committee called for that purpose; (7) the doctoral dissertation itself, and a final examination on the dissertation (Graduate School requirements). For details of these requirements and related matters, prospective students should consult the *Supplementary Guide for Graduate Students in the Field of Psychology,* which may be obtained from the graduate faculty representative.

Financial support for students is available in the form of teaching assistantships, research assistantships, predoctoral traineeships, and fellowships. The John Wallace Dallenbach Fellowship in Experimental Psychology is intended specifically for students in the Field of Psychology.

Research facilities include: special rooms for research in problems of perception and cognition; a social psychology laboratory equipped for experimental and observational studies of transitory and enduring groups; electrophysiological, histological, and chemical laboratories; major and minor surgery facilities; facilities for maintenance of, and behavioral study of, vertebrate and invertebrate laboratory animals; darkrooms and shops; an audiovisual studio equipped for the study of teaching; facilities for research with large laboratory animals, birds, and marsupials; laboratory computers and interacting terminals with the capacity to control equipment in experiments, to do on-line processing, and complex data analyses; a mobile laboratory for the study of children near their schools; and other specialized facilities, both on campus and at various off-campus locations.

The Field of Psychology cooperates with other fields in various interdisciplinary programs. The Fields of Psychology and Sociology jointly sponsor a program in personality and social psychology. The Fields of Psychology, Neurobiology and Behavior, Nutrition, and Physiology maintain close ties, and collaborative research with members of those fields is encouraged. The Field of Psychology also maintains close ties with the Field of Human Development and Family Studies.

Faculty and Specializations

Comparative Psychology
Evolution of behavior in a variety of vertebrates: animal social behavior, pheromones and chemical communication, auditory communication, species-specific learning abilities, comparative studies of taste aversions, evolution of feeding mechanisms in vertebrates, evolution of sexual behavior, development of social behavior and communication: E. K. Adkins, W. C. Dilger, B. Finlay, B. P. Halpern, R. E. Johnston, D. M. Zahorik

Developmental Psychology
Development of language, perception, thinking, intellectual development in natural settings, affective behavior in infancy, behavioral maturation, motivation and problem solving, cognitive socialization: A. W. Boykin, U. Bronfenbrenner, H. Feldman, E. J. Gibson, J. S. Harding, F. Keil, B. Koslowski, W. W. Lambert, L. C. Lee, H. Levin, U. Neisser, M. Potts, H. Ricciuti, R. E. Ripple, G. J. Suci

Differential Psychology and Psychological Tests
Psychometric theory including test theory, scaling, assessment methodology, factor analysis, applications in psychological research and in practical settings: H. A. Alker, R. B. Darlington, M. D. Glock, D. E. Hedlund, J. Millman

Experimental Psychology
The nature of discrimination, attention, the perceiving of the environment, the perceptual learning and development, the transmission of information, memory, the development of concepts, the formation of learning sets, teaching effectiveness, intrinsic and extrinsic motivation, conditioning: A. W. Boykin, L. Cooper, J. Cunningham, J. M. Farber, E. J. Gibson, J. J. Gibson, M. D. Glock, B. P. Halpern, R. E. Johnston, H. Levin, J. B. Maas, G. W. McConkie, U. Neisser, R. E. Ripple, S. Shattuck-Hufnagel, D. M. Zahorik

Experimental Psychopathology
Effects of stress and coping upon emotional behavior, disruption of performance, defenses and defensiveness, somatic pathology, and the relation of these phenomena to human psychopathology: H. A. Alker, J. Doris, R. Dworkin, H. Feldman, R. D. Mack

History and Systems of Psychology
H. A. Alker, U. Neisser

Mathematical Psychology
Mathematical and statistical methods in psychology, application of causal modeling techniques to complex social behavior: J. Cunningham, R. B. Darlington

Personality and Social Psychology
Aggressive behavior, anxiety and defenses, socialization, morality, experimental psychodynamics, personality assessment, emotional communication,

character and social development, reactions to psychoactive drugs and alcohol, nonverbal communication, new approaches to observation methodology, political psychology, cognitive consistency, small groups, interpersonal evaluations, guilt and persuasion, attitudes and behavior, attitude change, cross-cultural studies of socialization, self-concept, conflict resolution, time perspective: H. A. Alker, U. Bronfenbrenner, J. Condry, R. Dworkin, H. Feldman, L. W. Gruenfeld, T. Hammer, J. S. Harding, D. P. Hayes, S. C. Jones, R. E. Kraut, W. W. Lambert, T. M. Lodahl, R. D. Mack, L. Meltzer, D. Regan, B. C. Rosen, N. Rosen, K. Weick, L. K. Williams

Physiological Psychology
Sensory function, particularly taste and olfaction; sensory psychophysics; physiological mechanisms of sex and aggression; hormones and behavior; hormones and development of behavior; nutrition and development of the central nervous system and behavior; physiological and environmental determinants of feeding behavior and body weight regulation; diet and brain biochemistry and behavior; neurophysiological correlates of learning; choice and decision; sleep and dreams; behavior genetics: E. K. Adkins, B. Finlay, B. P. Halpern, R. E. Johnston, D. A. Levitsky, J. Maas, D. M. Zahorik

Psycholinguistics
The study of language acquisition, relations between language and other cognitive processes, the study of meaning, process of reading, the biological basis of language, linguistic intuitions and language use, speech perception and production: E. J. Gibson, F. Keil, H. Levin, U. Neisser, S. Shattuck-Hufnagel, G. Suci

Public Policy

Graduate Faculty Representative: Norman Uphoff, 170 Uris Hall

Minor Subject: Public Policy

Questions of public choice and policy applications are very real concerns within many disciplines, reflecting changes within our society. The complexities and interdependencies of the more industrialized societies and the inequities and immobilities in less developed countries pose problems more difficult and urgent than ever before. They require multidisciplinary analysis for which existing graduate education does not necessarily prepare a graduate student. The minor Field of Public Policy is designed to complement study in major fields such as government, economics, administration, anthropology, sociology, planning, ecology, engineering, industrial relations, or a physical science. The field contributes to a linking of analytical skills and substantive knowledge to deal with problems of public choice and public action.

Students choosing this as a minor field will usually write a dissertation bearing on some aspect of public policy. Seminars and course work as well as directed and independent reading will be organized to give the students multidisciplinary depth to the thesis and to subsequent teaching, research, and practice.

Faculty

H. E. Aldrich, D. J. Allee, D. E. Ashford, F. T. Bent, L. D. Chapman, P. Clavel, S. Clemhout, J. M. Cohen, E. T. Cranch, T. E. Davis, A. T. Dotson, P. R. Eberts, E. C. Erickson, M. J. Esman, E. S. Flash, Jr., W. W. Goldsmith, A. J. Hahn, K. L. Hanslowe, C. S. Hershey, B. G. Jones, R. J. Kalter, E. W. Kelley, I. Lazar, R. C. Lind, F. A. Long, D. P. Loucks, T. J. Lowi, J. W. Mellor, B. J. Mueller, D. W. Nelkin, G. H. Quester, R. Rosecrance, S. Saltzman, R. E. Schuler, S. W. Stein, R. S. Summers, N. T. Uphoff, J. Vanek, D. E. Van Houweling, D. H. White, W. F. Whyte, D. F. Williams

Regional Science

Graduate Faculty Representative: Stan Czamanski, 108 W. Sibley Hall

Major and Minor Subject: Regional Science

The Ph.D. program is designed to provide: (1) a thorough understanding of the underlying theory of location and spatial interaction of human activities in their economic, social, and political contexts; and (2) a mastery of techniques of analysis of regional systems designed to develop guidelines for public policy and private decisions. Heavy emphasis is placed upon mathematical models and quantitative methods. The student is fully exposed to the existing and newly developing social science theory which directly relates to the multidisciplinary approach of regional science. The course offerings focus on the socioeconomic aspects of the physical environment and on the spatial aspects of socioeconomic systems. Since work for the Ph.D. is considered preparatory to making creative contributions to the discipline, substantial competence in basic analytical and research methods will be required. Applicants are expected to have substantial preparation prior to entrance which may be supplemented by course work at Cornell.

There are no fixed admission requirements, but grades, class standing, GRE scores, and letters of recommendation must collectively indicate superior ability for creative research.

Students may ask any member of the Graduate Faculty to serve on their Special Committee. The chairperson must be a member of the graduate Field of Regional Science.

The primary objective of the postdoctoral program is to deepen our understanding of complex urban, regional, and spatial phenomena by: (1) bringing together within the regional science group scholars with diverse backgrounds in the social sciences, design, engineering, and related fields; (2) encouraging each scholar to probe areas of interest and challenge in unprogrammed independent ways; (3) establishing active, working relationships with one or more research teams at Cornell; and (4) exchanging ideas in informal regional science seminars held once or twice a week. It is expected that each postdoctoral scholar will undertake research of such a high quality as to lead to publication in scholarly journals such as the *Journal of Regional Science*.

Faculty and Specializations

D. J. Allee: resource economics; regional economics; regional development planning
R. Boisvert: economic development, employment, and income distribution
F. J. Cesario: transportation economics; travel demand modeling; spacial statistics; recreation economics and planning; environmental management; public systems analysis
S. Czamanski: economic analysis for planning; urban growth models; regional social accounts; regional applications of input-output analysis; location theory; housing economics
G. P. Fisher: transportation; systems analysis; engineering economics; policy analysis
W. W. Goldsmith: regional development planning and administration; economic analysis; urban and regional planning in developing countries
W. Isard: regional input-output analysis; gravity models; location theory; environmental management; general social science theory
B. G. Jones: urban and regional quantitative analysis; urbanization theory; planning theory; environmental health planning
R. J. Kalter: economic evaluation of public investment; water projects; recreation; environmental quality
D. P. Loucks: mathematical modeling of water resources and environmental quality management systems; urban noise control; regional development; multi-objective evaluation methods; engineering-economic-ecologic systems analysis
W. R. Lynn: environmental systems; planning and public policy issues
A. H. Meyburg: transportation systems; urban transportation planning; travel demand modeling; urban goods movements; airport planning and operations; transportation impact analysis
S. Saltzman: quantitative methods and systems analysis in planning; computers and information-processing systems
R. E. Schuler: urban and spatial economics; public finance and environmental economics
E. Thorbecke: development planning; theory of quantitative economic policy; international trade

Romance Studies

Graduate Faculty Representative: Edward P. Morris, 291 Goldwin Smith Hall

Major and Minor Subjects: French Linguistics, French Literature, Italian Linguistics, Italian Literature, Romance Linguistics, Spanish Linguistics, Spanish Literature

The Field of Romance Studies includes faculty members from three departments (Romance Studies, Comparative Literature, Modern Languages and Linguistics) and offers a diverse, interdisciplinary program of research and instruction in the modern languages and literatures deriving from Latin, "Romania." Courses in French, Italian, Portuguese, Romanian, and Spanish are given in the broad cultural and linguistic setting of a department providing instruction in general and applied linguistics, as well as in some thirty-five major languages and regional tongues. Romance studies seeks to maintain and transmit the traditional philological discipline, and to that end offers a full complement of courses in French, Italian, and Spanish literatures. It seeks also to incorporate the speculative, theoretical view of literature (sometimes showing the influence of philosophy, linguistics, and anthropology) current in Europe today, and reflected in the review *Diacritics*, which since 1971 has been edited and published by members of the field.

Students within the Field of Romance Studies may choose to work in either of two major subfields: Romance linguistics or Romance literature. Almost all students of Romance studies take some courses in both literature and linguistics. Appropriate minors may be drawn from such diverse areas as Afro-American studies, anthropology, applied linguistics, classics, comparative literature, English language and literature, general linguistics, Germanic studies, history, history of art, history of science, Latin American studies, medieval studies, musicology, Near Eastern (formerly Semitic) studies, Old Icelandic literature, philosophy, psycholinguistics, Romance linguistics, Slavic studies, sociology, theater arts (including cinema and dance), and women's studies.

In practice, most graduate students in Romance literature now elect only one minor subject; in Romance linguistics, two, one or both of which usually lie within the Field of Romance Studies (such as French or Spanish literature) or the Field of Linguistics (such as applied linguistics or general linguistics).

In Romance linguistics, the student is given training in four types of study and research: (1) general principles of linguistic analysis; (2) the description of the structure of the Romance language of major interest; (3) the external and internal history of that language; and (4) the genetic and typological relationships of the Romance family of languages. Special emphasis is laid on the relation between linguistic history and cultural factors (literary, political, and social). A concomitant aim of this area is to afford instruction and practice in the application of linguistics to the teaching of one or more Romance languages.

A candidate may choose as the major subject either the linguistics (descriptive and historical) of a specific Romance language or the comparative study of the Romance languages. Normally one of the minor subjects will be the literature of the language in which the student's major interest lies.

For the M.A., a candidate is expected to have command of two Romance languages (including the language of the major concentration) and the equivalent of a first-year course in Latin. For the Ph.D., a command of French and German is expected and the equivalent of a second-year course in Latin.

In Romance literatures, students choose one national literature as their major field. They are expected to acquire a basic working knowledge of the general history of that literature, along with the history of the national language, and to become conversant with social and intellectual history. They are expected to speak and write their major language fluently and correctly. They are trained in those bibliographical,

linguistic, and analytical skills basic to teaching and research in the interpretation of literature.

A certain number of graduate students in Romance studies each year obtain support from fellowships available in the Graduate School. Relatively large undergraduate enrollments in French, Italian, and Spanish courses (both in language and literature) require the employment of numerous teaching assistants. First-year graduate students are not normally eligible for teaching assistantships unless they come to Cornell with an M.A. or considerable teaching experience. Every attempt is made to provide new teachers with careful guidance and support. A special summer course on the teaching of language allows beginning assistants to observe and participate in the classroom teaching of French or Spanish and to attend lectures and discussions on theory and practice.

The field does not have a formalized program for study in Europe, but students are encouraged to spend a term or a year abroad whenever study in another country seems appropriate—either for improvement of language skills or for the advancement of their research. Close ties of professional acquaintance make it possible for students in French or Italian to attend seminars at such institutions as the Ecole Normale Supérieure and the Ecole Pratique des Hautes Etudes in Paris, or the University of Bologna. Students in Spanish often conduct thesis research in archives or libraries in such cities as Madrid, Seville, Mexico City, and Lima. A special endowment allows the Department of Romance Studies to provide some of its students with small subsidies for study abroad.

Applicants must include scores of the Aptitude and Advanced Tests of the Graduate Record Examinations with their other credentials, and are urged to take those examinations by mid-December.

For course offerings, please see *Cornell University Announcements: Description of Courses,* under the headings "Comparative Literature" and "Modern Languages, Literatures, and Linguistics".

Faculty and Specializations

J. Béreaud: stylistics; French civilization
A. Colby-Hall: French philology; medieval French language and literature; stylistics
N. Furman: nineteenth-century French literature
A. Grossvogel: nineteenth- and twentieth-century Italian literature
D. I. Grossvogel: twentieth-century French literature; literature and cinema
J. W. Harari: eighteenth-century French literature; contemporary French criticism
J. Herschensohn: French linguistics; comparative Romance linguistics
W. W. Holdheim: history of ideas; contemporary French literature
W. J. Kennedy: French and Italian Renaissance literature
L. D. King: Portuguese and Spanish linguistics
R. J. Klein: nineteenth- and twentieth-century French literature; literary criticism
W. H. Klemme: Spanish linguistics
J. W. Kronik: nineteenth- and twentieth-century Spanish literature
P. E. Lewis: seventeenth- and nineteenth-century French literature; semiotics
G. Mazzotta: medieval Italian literature
C. Morón-Arroyo: Spanish intellectual history; medieval and modern literature
E. P. Morris: sixteenth-century French literature; literature and visual arts; literary history and musicology
J. S. Noblitt: French linguistics; applied linguistics
M. Randel: Spanish literature of the Golden Age
E. M. Santí: Hispanic American literature
A. Seznec: seventeenth-century French literature
D. F. Solá: Spanish linguistics; Quechua
M. Suñer: Spanish linguistics
M. Van Antwerp: Spanish literature of the Golden Age
L. Waugh: French linguistics; semantics

Slavic Studies

Graduate Faculty Representative: Stephen S. Lottridge, 362 Goldwin Smith Hall

Major and Minor Subjects: Russian Literature, Slavic Linguistics

The student in Slavic studies plans an individual program in consultation with the Special Committee chairperson and other members of that committee representing the minor subjects. A student who chooses either Russian literature or Slavic linguistics as a major may choose the other for a minor or may choose minor subjects from other fields in the University; such as other literatures, linguistics, history, government, economics, psychology, mathematics, computer science, philosophy, and music. A Ph.D. candidate will normally have two minor subjects, although it is possible to plan with the Special Committee chairperson a program of studies with only one; in the latter case the student is still required to select a total of three professors to serve on the Special Committee.

The progress towards the degree is determined by oral and written comprehensive examinations given at three points in the student's career: at the end of the first year of work to assess the student's capacity for Ph.D. work and to assist in planning the student's program of study; at the end of the third year of study (or sooner if the student is prepared) to assess the student's mastery of the materials of study; and after completion of the dissertation (defense of the dissertation).

Candidates for the M.A. degree are required to demonstrate a reading knowledge of either French or German. Candidates for the Ph.D. are required to demonstrate a reading knowledge of both languages.

Candidates for the Ph.D. degree are normally required to spend two semesters as teaching apprentices as a part of their training towards the degree.

Faculty and Specializations

L. Babby: Slavic linguistics
P. Carden: nineteenth- and twentieth-century prose; modernism and the avant-garde; critical theory
G. Gibian: nineteenth-century prose; 1920s; contemporary literature

R. Leed: historical Slavic linguistics; Russian dialectology; intonation
S. Lottridge: nineteenth- and twentieth-century prose
V. Ripp: nineteenth-century prose; theory of the novel; Turgenev
S. Senderovich: eighteenth- and nineteenth-century literature; Russian poetry

Sociology

Graduate Faculty Representative: Joseph A. Kahl, 322 Uris Hall

Major Subjects: General Sociology, Demography-Ecology, Research Methodology, Social Organization and Change, Social Psychology

Minor Subjects: Demography-Ecology, Research Methodology, Social Organization and Change, Social Psychology

All inquiries about the graduate program in sociology should be made directly to the graduate faculty representative. A brochure, *Sociology at Cornell,* will be sent on request. Graduate Record Examinations scores are required.

M.A. candidates major in general sociology, which covers the four specific subjects of social organization and change, research methodology, demography-ecology, and social psychology.

Students in the Ph.D. program may register in general sociology initially, but must select one of the four major subjects before taking the admission to candidacy examination.

All students in the Ph.D. program are required to have one year of directed teaching experience at Cornell unless specifically exempted. Typically, this teaching practicum is scheduled for the second year of residence. In addition, students in the M.A. and Ph.D. programs are expected to prepare themselves to undertake research, both through formal course work and through exposure to the ongoing research activities of the faculty.

Candidates in full-time residence are normally expected to complete the Ph.D. degree within four years of the A.B. degree. A diagnostic qualifying examination may be held at the request of the student or the Special Committee.

Subject Descriptions

Demography-Ecology This major requires (1) a thorough knowledge of demographic and ecological theory and substantive research; (2) a thorough knowledge of the techniques of demographic and ecological data collection and analysis; (3) a working knowledge of the theory and methods of social organization and change.

Research Methodology This major requires (1) a detailed knowledge of the logic of science; (2) a general knowledge of research design, data collection techniques, and analytical procedure; (3) a working knowledge of the theory of social organization and change; (4) a concentration of study in one of the areas listed in (1) and (2).

Social Organization and Change This major requires (1) a thorough knowledge of theories of and research in social organization and change; (2) a working knowledge of research methods; (3) a detailed knowledge of two subfields in social organization.

Social Psychology This major requires (1) a thorough knowledge of social psychological theory and research; (2) a working knowledge of the methodology of social psychological research; (3) a working knowledge of psychology, sociology, and relevant aspects of other related disciplines; and (4) a detailed knowledge of some specialized aspect of social psychology.

Faculty and Specializations

Many of the investigations by the faculty have been done in cross-cultural settings: Africa, Asia, Latin America, and Europe. Staff members also participate in the Center for International Studies and various area study programs.

Comparative: R. Avery, R. K. Goldsen, J. A. Kahl, W. W. Lambert, B. C. Rosen, W. F. Whyte, R. M. Williams, Jr.
Demography: R. Avery, P. Chi, B. Edmonston, J. M. Stycos
Family and sex roles: J. L. Laws, B. C. Rosen, J. M. Stycos
Formal and complex organizations: H. Aldrich, S. Bacharach, R. Stern, H. Trice, W. F. Whyte, R. M. Williams, Jr.
Mathematical: P. Allison, S. Caldwell, P. Chi, R. McGinnis
Medical sociology: B. Edmonston, M. Goss, G. Reader
Methods and statistics: R. Alba, P. Allison, S. Caldwell, P. Chi, R. K. Goldsen, D. P. Hayes, R. McGinnis
Political sociology: H. Aldrich, H. Alker, C. Sheingold
Social organization and change: R. Alba, S. Bacharach, J. B. Jacobs, B. C. Rosen, C. Sheingold, R. Stern, H. Trice, W. F. Whyte, R. M. Williams, Jr.
Social psychology: H. Alker, D. P. Hayes, S. Jones, R. E. Kraut, W. W. Lambert, J. L. Laws, L. Meltzer, D. Regan, B. C. Rosen
Stratification and mobility: R. Alba, S. Caldwell, D. P. Hayes, J. A. Kahl, R. McGinnis
Urban: H. Aldrich, P. Chi, B. Edmonston, J. B. Jacobs

Statistics

Graduate Faculty Representative: S. R. Searle, 339 Warren Hall

Major Subject: Statistics

Applicants should ordinarily have obtained the approximate equivalent of an undergraduate major in mathematics. It is strongly recommended that applicants present scores on the Graduate Record Examinations Aptitude Tests.

Each candidate for a Ph.D. degree shall, before the Ph.D. thesis oral exam, demonstrate to the chairperson of his or her Special Committee a level of proficiency in one of French, German, Russian, Chinese, Japanese, or Spanish.

In addition to the examinations required by the Graduate School, students in the Ph.D. program will be

given a qualifying examination shortly after the first term of graduate study.

Faculty and Specializations

Analysis and probability theory: T. Berger, E. Dynkin, D. C. Heath, H. Kesten, N. U. Prabhu, F. L. Spitzer, M. S. Taqqu, H. M. Taylor III, L. Weiss
Bayesian inference: D. L. Solomon
Biological applications of probability and statistics: F. B. Cady, W. T. Federer, D. S. Robson, S. R. Searle, D. L. Solomon
Biomedical applications of statistics: R. E. Bechhofer, W. T. Federer, T. J. Santner, B. W. Turnbull
Design and analysis of experiments: R. E. Bechhofer, F. B. Cady, W. T. Federer, J. C. Kiefer, T. J. Santner, S. R. Searle, B. W. Turnbull
Engineering and operations research applications of probability and statistics: R. E. Bechhofer, T. Berger, T. L. Fine, D. C. Heath, N. U. Prabhu, T. J. Santner, M. S. Taqqu, H. M. Taylor III, B. W. Turnbull, L. Weiss
Foundations of probability: T. L. Fine
Information theory: T. Berger
Linear models: S. R. Searle
Mathematical economics: E. Dynkin
Mathematical theory of probability and statistics: E. Dynkin, R. H. Farrell, M. Finster, D. C. Heath, H. Kesten, J. C. Kiefer, N. U. Prabhu, F. L. Spitzer, M. S. Taqqu
Multivariate analysis: I. Blumen, R. H. Farrell, I. Francis, S. R. Searle
Nonparametric statistics: I. Blumen, B. W. Turnbull, L. Weiss
Optimal design: R. H. Farrell, W. T. Federer, J. C. Kiefer
Queuing and inventory theory: N. U. Prabhu
Ranking and selection procedures: R. E. Bechhofer, T. J. Santner, B. W. Turnbull
Regression analysis: F. B. Cady
Robust statistics: P. F. Velleman
Sampling theory: P. J. McCarthy, D. S. Robson
Social science applications of probability and statistics: I. Blumen, I. Francis, P. J. McCarthy, P. F. Velleman
Statistical computing: I. Francis, S. R. Searle, P. F. Velleman
Statistical control theory: E. Dynkin, H. M. Taylor III
Statistical design construction and combinatorics: W. T. Federer, J. C. Kiefer
Statistical modeling: W. T. Federer, D. S. Robson, D. L. Solomon
Statistical theory: R. H. Farrell, J. C. Kiefer, D. S. Robson, D. L. Solomon, L. Weiss
Stochastic processes: E. Dynkin, D. C. Heath, H. Kesten, N. U. Prabhu, M. S. Taqqu, H. M. Taylor III

Theatre Arts

Graduate Faculty Representative (M.A./Ph.D.): Bert O. States, 212 Lincoln Hall

Graduate Faculty Representative (M.F.A.): Stephen R. Cole, 110 Lincoln Hall

Major Subjects: Theatre Arts (drama and the theatre, theatre history, theatre theory and aesthetics); Acting (major for the M.F.A.)

Minor Subjects: Theatre Arts; Cinema; Design for the Theatre; Playwriting

For the M.A. and Ph.D. degrees, Graduate Record Examinations Aptitude Test scores are required. For the M.F.A. degree, interviews and audition sessions are required. Direct admission to the doctoral program is restricted to those with M.A. degrees.

The normal language requirement for the Ph.D. degree is proficiency in two foreign languages, but the Special Committee may approve a single language at a higher proficiency. For the Ph.D., a qualifying examination is given in the third term of residence; it may be combined with the final examination for the M.A. degree. The program leading to the Master of Fine Arts degree in acting requires a minimum of two years in residence while the M.F.A. in design and directing requires three. These programs emphasize training in workshop and studio. A final project replaces the conventional final examination. The M.F.A. is a terminal degree.

Research and Study Opportunities

The chief aim of the Ph.D. program in theatre arts is to develop competent scholars, teachers, and directors for the educational theatre. Therefore, research, teaching, and production will be included to a meaningful extent in each Ph.D. program.

Opportunities are offered for study and research in many phases of the discipline, including dramatic literature; history, criticism, and aesthetics of the theatre; playwriting; cinema; and most aspects of theatrical production.

Faculty and Specializations

M. A. Carlson: dramatic literature; theatre history
S. R. Cole: acting; directing; theatre aesthetics
D. Fredericksen: cinema
P. Lawler: dance
R. Shank: directing; acting
B. O. States: playwriting; dramatic theory
D. Tschetter: design (M.F.A. only)

Theoretical and Applied Mechanics

Graduate Faculty Representative: G. S. S. Ludford, 232 Thurston Hall

Major and Minor Subjects: Dynamics and Space Mechanics, Fluid Mechanics, Mechanics of Materials, Solid Mechanics

The program emphasizes learning of the fundamental principles of science and understanding of the newest developments in engineering. Graduate students may pursue in-depth studies in mechanics of particles, rigid and deformable solids, dynamics of liquids and gases, mechanical properties of materials, and other related subjects in physics and mathematics. Current research topics include: (1) dynamics and space mechanics—stability and nonlinear oscillations of particles, dynamical systems, trajectories and orbits of space vehicles, celestial mechanics, planetary dynamics; (2) fluid mechanics—Newtonian and non-Newtonian fluids, stability of flow, magnetogasdynamics,

combustion; (3) mechanics of materials—failure and fracture of solids, static and dynamic properties of solids and fluids; (4) solid mechanics—wave propagation in solids, static and dynamic response of structures, elasticity, plasticity, creep, magneto-solid mechanics, continuum mechanics; (5) bionics and robots, pattern classification, mathematical ecology, biodynamics.

The field admits students with backgrounds in physics, mathematics, and any branch of engineering. Students applying for financial aid are expected to submit Graduate Record Examinations scores.

Students enrolled in the Ph.D. program must take a qualifying examination by the end of the third semester in residence. Each doctoral candidate must demonstrate reading ability in one language other than the native language. The field also requires teaching experience of all doctoral candidates.

Teaching assistantships and a limited number of research assistantships are available. Applications for assistantships are considered along with admission to the field and no separate form is needed.

Professional Degree

The Master of Engineering (Engineering Mechanics) degree program is intended for students interested in advanced study in mechanics with emphasis on engineering practice rather than teaching or research. The course of study is designed to allow the student to master advanced topics in mechanics and develop skill in applying fundamental concepts in experimental and analytical aspects of mechanics to modern technological problems. For further information see *Graduate Study in Engineering and Applied Science at Cornell.*

Faculty

H. D. Block, J. A. Burns, H. D. Conway, E. T. Cranch, P. A. Dashner, E. W. Hart, P. J. Holmes, J. T. Jenkins, H. H. Johnson, R. H. Lance, S. A. Levin, G. S. S. Ludford, F. C. Moon, S. Mukherjee, Y. H. Pao, R. H. Rand, W. H. Sachse

Toxicology

Graduate Faculty Representative: C. F. Wilkinson, 196 New Insectary, Department of Entomology

Minor Subject: Toxicology

Toxicology is a minor field of specialization and consequently prospective students must first be admitted to an appropriate major field of the Graduate School. The field provides an opportunity for students wishing to broaden their knowledge of the interactions of toxic elements and chemicals (drugs, pesticides, industrial pollutants, and natural products) with living organisms and the environment. Specific program areas of field faculty members range from basic studies on the neuropharmacology and mechanism of action of toxicants to investigations of their metabolic degradation, environmental fate, and potential toxicological hazard to man and higher animals. Students will be required to select a minimum of three courses from a prescribed list and to attend and participate in a field seminar program.

Faculty and Specializations

M. Alexander: microbial metabolism of toxicants
A. L. Aronson: clinical toxicology; pharmacokinetics
T. C. Campbell: chemical carcinogenesis; metabolism of foreign compounds and nutritional interactions
D. J. Lisk: analysis of toxic residues; environmental systems
R. D. O'Brien: neuropharmacology and comparative toxicology
W. S. Schwark: pharmacology and neurochemistry
G. S. Stoewsand: toxicology and public health aspects of foods
C. F. Wilkinson: insecticide chemistry; comparative toxicology and biochemistry
R. G. Young: comparative biochemistry

Urban Studies

Graduate Faculty Representative: Barclay G. Jones, 111 W. Sibley Hall

Minor Subject: Urban Studies

Urban studies is an interdisciplinary minor field that provides students an opportunity to develop knowledge and understanding of urban society. It is intended to complement basic studies in such major fields as government, sociology, economics, history, city and regional planning, engineering, business and public administration, and human development. It should develop the student's competence in such subject areas as theories of urbanization, urban political processes, public policy and administration, urban ecology, urban economics, urban social structure, urban planning, and the processes of urban change. Because of the field's interdisciplinary character, students may not, for this minor, select a professor who also serves on the graduate faculty in the student's major field.

The student's dissertation research must show a close integration between the major field and the particular aspect of urban studies that has been selected. There will be opportunities for research support through the Program in Urban and Regional Studies and through other University facilities.

Faculty and Specializations

H. E. Aldrich: organizational behavior
P. S. K. Chi: sociology
P. Clavel: city and regional planning
S. Clemhout: consumer economics
A. T. Dotson: government
P. R. Eberts: rural sociology
E. S. Flash, Jr.: public administration
W. W. Goldsmith: city and regional planning
C. Hershey: city and regional planning
B. J. Jones: city and regional planning
P. W. Martin: law
J. W. Reps: city and regional planning
S. Saltzman: city and regional planning
R. E. Schuler: economics
S. W. Stein: urban planning and design

J. E. Turner: Africana studies
D. Van Houweling: government
H. Y. Wan: economics

Vegetable Crops

Graduate Faculty Representative: Peter Minotti, 162 Plant Science Building

Major and Minor Subject: Vegetable Crops

The field offers graduate training leading to the Master of Professional Studies (Agriculture), Master of Science, and Doctor of Philosophy degrees. Students who wish to obtain a Ph.D. degree are expected to obtain a master's degree first.

A good background in biological and agricultural sciences, together with an interest in economic plants is desirable, and farm experience is an advantage.

Research and study in this field involve the application of scientific knowledge and methods to the solution of problems in the production, handling, processing, and marketing of vegetables, including potatoes and dry beans. Depending upon the student's interests, it is possible to prepare for careers in such diverse areas as university teaching; international agriculture; applied or basic biological research; agricultural extension; governmental regulatory agencies; or commercial work with producers of seeds, agricultural chemicals, and food processors.

Facilities include ample greenhouse space; a bioclimatic laboratory complex, including cold storage rooms; a pilot plant at Geneva; research farms at Ithaca, Geneva, and Riverhead, Long Island; and laboratories well equipped for physiological, anatomical, genetic, and biochemical investigations. A limited number of assistantships are available to qualified applicants for training in research; teaching or extension.

In addition to the examinations required by the Graduate School, for the Ph.D. degree the field requires a qualifying examination which is taken early in the program, preferably no later than the second term of residence.

All M.S. and Ph.D. candidates are encouraged to obtain teaching experience.

Faculty and Specializations

D. W. Barton*, M. H. Dickson*, G. A. Marx*, H. M. Munger, R. W. Robinson*, D. H. Wallace: breeding and genetics
E. E. Ewing: potatoes, especially the physiology of heat tolerance, tuberization, and carbohydrate metabolism
J. R. Hicks: postharvest physiology
W. C. Kelly, R. F. Sandsted: vegetable crop physiology and production
P. L. Minotti: nutrition and physiology of crops and weeds
N. H. Peck*, mineral nutrition, fertilization, and cultural practices

* Faculty at the New York State Agricultural Experiment Station in Geneva.

G. W. Selleck: autecology and weed control
G. Shannon*: biochemistry; nutrition; and physiology
R. Sheldrake: greenhouse crops; structures, systems; soil management and nutrition
R. D. Sweet: chemical and biological weed control
L. D. Topoleski: vegetable crops extension (noncommercial); pollen physiology and interspecific incompatibility
M. T. Vittum*: climatology and soil-plant-water relationships

Veterinary Medicine

Graduate Faculty Representative: J. F. Cummings, 417 VRT, College of Veterinary Medicine

Major and Minor Subject: Veterinary Medicine (animal physiology, immunology, parasitology, physical biology, theriogenology, veterinary anatomy, veterinary bacteriology, veterinary medicine, veterinary pathology, veterinary pharmacology, veterinary surgery, veterinary virology)

All applicants should submit results of the Graduate Record Examinations Aptitude Test taken during the past four years. Scores of an Advanced Test are also desirable.

The D.V.M. degree is required of most applicants for admission in the clinical areas of study.

The field does not require reading knowledge of a foreign language. It should be noted, however, that the student's Special Committee may enforce such a requirement.

Facilities for graduate study and research in all areas of basic and applied veterinary medicine offer many unique opportunities. In addition to the excellent University libraries, the College has a specialized collection of more than 57,000 volumes and 1,000 current serials. A large and varied clinic representing all domestic animals is available as a source of material. In addition to the animal quarters, pastures, and laboratories on the main campus, the College operates several farm and research facilities nearby. These include virus disease laboratories, poultry disease facilities, and sheep and cattle disease farms.

Graduate students may work for the M.S. or Ph.D. degree, or the D.Sc. in V.M. (Doctor of Science in Veterinary Medicine). The latter degree is characterized by a professional rather than a research objective. (See the *Announcement of the New York State College of Veterinary Medicine* for a full description of the requirements.) A student who holds the D.V.M. degree from a recognized college in the United States or Canada may transfer one year's residence credit for that work toward the Ph.D. degree. Combined D.V.M.-Ph.D. and D.V.M.-M.S. programs have been instituted.

Faculty and Specializations

Anatomy
Applied anatomy of domestic mammals: R. E. Habel
Comparative neurology: J. F. Cummings, A. de Lahunta

Developmental biology—development and differentiation in connective tissues: R. R. Minor
Gross and microscopic functional anatomy of the digestive system, particularly of ruminants: J. F. Cummings, R. E. Habel, W. O. Sack
Gross comparative anatomy of vertebrates: H. E. Evans
Mammalian embryology, teratology, and development: H. E. Evans, R. R. Minor, W. O. Sack

Immunology
Cell-mediated immunity: V. L. Utermohlen
Cellular resistance to infection: D. D. McGregor
Clinical aspects of immunologic diseases: R. D. Schultz
Immunochemical studies of bacterial and viral antigens: N. L. Norcross, R. D. Schultz, A. J. Winter
Ontogenetic studies of the immune response; neonatal immunity: S. G. Campbell, R. D. Schultz
Quantitative and qualitative studies of cellular and humoral immune responses in normal and pathological states: S. G. Campbell, G. L. Cockerell, N. L. Norcross, R. D. Schultz, D. O. Slauson
Secretory immunity, particularly of the reproductive tract and the mammary gland: N. L. Norcross, A. J. Winter

Parasitology
Diagnosis and treatment of parasitic diseases of domestic animals: J. R. Georgi, J. H. Whitlock
Quantitative interactions of host and parasite systems with the environment: J. R. Georgi, J. H. Whitlock
Taxonomy, bionomics, and comparative anatomy and physiology of helminths: J. R. Georgi, J. H. Whitlock

Pharmacology
Analytic chemistry and toxicology of organic and inorganic materials studied by mass spectrometry and x-ray, fluorescence spectrometry: J. D. Henion
Drug testing and toxicology: G. A. Maylin
Thyroid hormone and brain chemistry, particularly in the developing brain: W. S. Schwark
Toxicity of chelating agents with emphasis on the pathogenesis of toxicity: A. L. Aronson

Physical Biology (including Radiation Biology)
Biological effects of radiation: A. P. Casarett
Environmental contamination; veterinary statistics: J. C. Thompson, Jr.
Fission product metabolism in domestic animals: F. W. Lengemann
Veterinary nuclear medicine: F. A. Kallfelz

Physiology
Absorbtion and blood flow in the gastrointestinal tract, particularly the ruminant forestomach: A. Dobson
Basement membrane; biosynthesis, secretion, deposition, and turnover: R. R. Minor
Behavior of domestic animals: K. A. Houpt
Biochemical characterization of cartilage and pathogenesis of degenerative disease in hip joints of developing dogs: G. Lust
Comparative gastroenterology; gastric and large intestine secretory and absorptive functions: C. E. Stevens
Comparative physiology of food intake control: K. A. Houpt, T. R. Houpt
Connective tissue: regulation of the synthesis and organization of collagen, elastin, and proteoglycans: R. R. Minor
Endocrine mechanisms: R. A. Corradino
Enzymology of intermediate metabolism with emphasis on membrane-associated functions: W. J. Arion
Enzymology of protein digestion with emphasis on structural functional relationships: J. R. Wooton
Equid large intestine: A. F. Sellers
Metabolism and nutrition: F. W. Lengemann
Mineral metabolism: F. A. Kallfelz
Mineral metabolism, intestinal absorption mechanisms, membrane transport: R. H. Wasserman
Neurophysiology—sensory and central integrative processes: D. N. Tapper
Neurophysiology—vertebrate central nervous systems, nerve nets: E. L. Gasteiger
Ruminant metabolism with emphasis on the entire animal, liver, digestive tract, and kidneys: E. N. Bergman
Urea metabolism in herbivores: T. R. Houpt

Theriogenology (Animal Reproduction)
Mammalian cytogenetics and biometrics: H. O. Dunn
Reproductive pathology: D. H. Lein, K. McEntee

Veterinary Bacteriology
Bacterial depuration in shellfish: J. F. Timoney
Canine brucellosis—diagnosis, pathogenesis, and control: L. E. Carmichael
Corynebacterial and mycobacterial infections: S. G. Campbell
Ecology and genetics of resistance plastids: J. F. Timoney
Erysipelas arthritis in swine: J. F. Timoney
Infections of fin-fish, shellfish, and water fowls: L. Leibovitz
Mycoplasma—culture, classification, and pathogenicity: J. Fabricant
Salmonellosis—pathogenesis, virulence factors, and epidemiology: R. F. Kahrs, J. F. Timoney
Streptococcal and staphylococcal diseases: N. L. Norcross
Vibriosis and other infections of the bovine reproductive tract: A. J. Winter

Veterinary Medicine
Biomechanics: J. E. Lowe, H. F. Schryver
Clinical nutrition and metabolic disease: H. F. Hintz, F. A. Kallfelz, J. E. Lowe, H. F. Schryver, B. E. Sheffy
Comparative gastroenterology: F. A. Kallfelz, B. C. Tennant
Comparative neurology: J. F. Cummings, A. de Lahunta
Dermatology: R. W. Kirk
Epidemiology and preventive medicine: R. H. Cypess, N. B. Haynes, R. F. Kahrs
Internal medicine: F. H. Fox, R. W. Kirk, E. C. Melby, Jr., B. C. Tennant
Laboratory medicine (hematology, clinical chemistry, and clinical microbiology): J. Bentinck-Smith, J. B. Tasker
Radiology and nuclear medicine: F. A. Kallfelz

Veterinary Pathology
Cells and mediators of inflammation: D. O. Slauson
Clinical pathology (hematology, clinical chemistry, and clinical microbiology): J. Bentinck-Smith, J. B. Tasker
Comparative medicine: G. C. Poppensiek
Comparative pulmonary pathology: D. O. Slauson
Connective tissue disease: R. R. Minor
Developmental pathology: R. R. Minor

Diagnostic pathology: J. M. King, G. L. Cockerell
Diseases of laboratory animals, fish, and amphibia: C. I. Boyer, Jr., E. C. Melby, Jr.
Electron microscopy—SEM and TEM for teaching, research, and diagnostics: R. R. Minor
Immunopathology: G. L. Cockerell, R. H. Cypess, R. M. Lewis, D. O. Slauson
Oncology, including tumor pathogenesis, virology, and immunology: K. M. Lee, F. Noronha, C. G. Rickard
Pathology of nutritional diseases: L. P. Krook
Reproductive pathology: D. H. Lein, K. McEntee

Veterinary Surgery
General surgery: R. E. Hoffer, J. E. Lowe
Orthopedic surgery: R. Dueland, E. Trotter
Pathophysiology of anesthesia: C. E. Short

Veterinary Virology
Aquatic viral diseases: M. J. Appel, C. I. Boyer, Jr., J. H. Gillespie, J. M. King, L. Leibovitz
Avian viral diseases, respiratory and oncogenic; diagnostic methods: B. W. Calnek, J. Fabricant, S. B. Hitchner, M. Peckham
Bovine viral diseases—etiology, pathogenesis, epidemiology, and host response: J. H. Gillespie, R. F. Kahrs, R. D. Schultz, F. Scott, B. Sheffy
Canine viral diseases—etiology, pathogenesis, epidemiology, and host response: M. J. Appel, L. E. Carmichael, G. Lust, R. D. Schultz, B. E. Sheffy
Comparative medicine: G. C. Poppensiek
Effects of nutrition on host response to selected canine viruses: B. E. Sheffy
Equine viral diseases—etiology, pathogenesis, epidemiology, and host response: L. Coggins
Etiologic and epidemiologic studies of bovine winter dysentery: S. G. Campbell, R. F. Kahrs, F. W. Scott, C. E. Stevens, B. C. Tennant
Feline urolithiasis: J. H. Gillespie, L. P. Krook
Feline viral diseases—etiology, pathogenesis, epidemiology, and host response: G. L. Cockerell, J. H. Gillespie, K. M. Lee, F. W. Scott
Principles and procedures for epidemiologic investigation of animal disease outbreaks: R. F. Kahrs
Tumor viruses—immunology, virology, and pathology: G. L. Cockerell, K. M. Lee, F. M. Noronha, C. G. Rickard, R. D. Schultz
Viral diseases: V. L. Utermohlen

Water Resources

Graduate Faculty Representative: Charles D. Gates, 221 Hollister Hall

Minor Subject: Water Resources

Water resources is a *minor* field of concentration at Cornell; consequently a prospective student must first be admitted to a *major* field of the Graduate School.

This minor field offers qualified engineers and biological, physical, and social scientists an opportunity to gain breadth of knowledge in water resources planning and management through an interdisciplinary program of study intended to complement their major subject.

The minor will represent for each candidate that combination of courses, seminars, and projects outside the major field which the Special Committee considers most appropriate to the interdisciplinary aspects of the degree program.

Major subjects are ordinarily chosen from the following list: aerial photographic studies and remote sensing, aquatic ecology, aquatic science, chemical engineering, city and regional planning, economic theory, engineering geology, environmental systems engineering, fishery science, hydraulics and hydrology, meteorology, natural resources conservation, operations research, public administration, resource economics, sanitary engineering, soil and water engineering, soil science, water resource systems.

Faculty

D. J. Allee, R. D. Black, L. B. Dworsky, C. D. Gates, D. A. Haith, L. S. Hamilton, G. A. Kiersch, G. Levine, D. P. Loucks, W. R. Lynn, B. T. Wilkins.

Women's Studies

Graduate Faculty Representative: Jennie Farley, 393 Ives Hall

Minor Subject: Women's Studies

Women's studies is a minor field of concentration at Cornell; a prospective student must be admitted to a major field of the Graduate School first and then may elect a minor in women's studies. The minor is interdisciplinary, representing a focus within general humanistic and social science scholarship. Women's studies encompasses not only the study of women but the general investigation of sex roles and their significance. There are five core areas: ideology and culture, institutions and society, history, literature and the arts, and psychology and human development.

Faculty

R. A. Borker, J. R. Egner, J. Farley, H. Feldman, N. Furman, M. F. Katzenstein, J. L. Laws, S. McConnell-Ginet, M. B. Norton

Zoology

Graduate Faculty Representative: William A. Wimsatt, G-45 Emerson Hall

Major and Minor Subjects: Animal Cytology, Comparative and Functional Anatomy, Ecology, Embryology, Histology, Invertebrate Zoology

Applicants must submit scores of the Graduate Record Examinations Aptitude and Advanced Biology Tests.

All applicants should have completed the equivalent of a college major in zoology, with some foundation in the particular phase of zoology they desire to pursue, and should have taken courses in organic chemistry, elementary physics, and calculus.

A reading knowledge of French, German, or Russian (in addition to English) is required of all candidates for the Ph.D. degree unless the candidate's Special Committee recommends substitution of another language.

All candidates entering a Ph.D. program will take a prescription examination not later than the beginning of their second term of residence.

All Ph.D. candidates are expected to perform in a teaching capacity for a minimum of two semesters.

There are excellent opportunities for study and research in most phases of zoology, particularly in the descriptive and experimental aspects of the following special subjects: comparative and vertebrate anatomy with emphasis on the functional approach, developmental biology, general ecology, cytology, histology and descriptive embryology, invertebrate zoology, and vertebrate zoology.

Faculty and Specializations

J. M. Anderson: general and comparative anatomy of invertebrates, with emphasis on functional histology and histochemistry of organ systems

A. W. Blackler: origin of sex cells and nucleocytoplasmic interaction in development

S. E. Bloom: cytology and cytogenetics of avian species; applications of cytochemistry and cytophotometry in the animal and plant sciences

T. J. Cade: environmental biology of vertebrates; ornithology; biology of raptorial birds

L. C. Cole: general ecology, with special emphasis on population phenomena and the mathematical theory of populations

H. E. Evans: comparative vertebrate morphology; the prenatal development of the dog

P. W. Gilbert: vertebrate functional anatomy (correlation of habits and activities of vertebrates with their morphology); biology of elasmobranch fishes with emphasis on reproductive patterns and sense organs

R. L. Hallberg: molecular aspects of development with particular reference to biochemical processes during amphibian oogenesis

J. W. Hudson: environmental physiology; comparative physiology; respiration, hibernation, temperature regulation (particularly of mammals)

F. H. Pough: environmental physiology, especially of lower vertebrates; herpetology

W. A. Wimsatt: vertebrate histology with emphasis on histophysiological, histochemical, and ultrastructural aspects of reproduction, digestion, placentation, and hibernation

Cornell University

Register

University Administration

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Dale R. Corson, Chancellor of the University
David C. Knapp, University Provost
Theodore Cooper, Dean of the Medical College and Provost for Medical Affairs
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Byron W. Saunders, Dean of the University Faculty
Neal R. Stamp, University Counsel and Secretary of the Corporation

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William W. Lambert, B.A., M.A., Ph.D., Dean of the Graduate School
Alison P. Casarett, B.S., M.S., Ph.D., Associate Dean of the Graduate School
Benjamin P. Bowser, B.A., Ph.D., Assistant Dean of the Graduate School
Donald P. Hayes, B.S., M.A., Ph.D., Secretary of the Graduate Faculty

General Committee

Members-at-Large

Harold A. Scheraga (1979)
Bruce T. Wilkins (1979)
Gordon Messing (1981)
Lawrence Williams (1981)

Humanities

Phillip L. Marcus (1979)
Esther Dotson (1981)

Social Sciences

Daniel G. Sisler (1979)
Frank Young (1981)

Biological Sciences

Robert H. Foote (1979)
Richard P. Korf (1981)

Physical Sciences

Chung L. Tang (1979)
Yervant Terzian (1981)

University Professors-at-Large

Professors-at-Large are distinguished non-resident members of the University faculty. During short visits to the campus of up to a month's duration, made at irregular intervals, they hold seminars, give public lectures, and consult informally with students and faculty.

Kenneth E. Boulding (economist)
Howard M. Brown (music historian)
Joaquin Cravioto (nutritionist)
Ronald M. Dworkin (lawyer)
Pierre-Gilles de Gennes (physicist)
Louis Guttman (sociologist)
Eric J. Hobsbawm (historian)
Sir Fred Hoyle (astrophysicist)
Samuel Karlin (mathematician)
H. Gobind Khorana (biochemist)
Saul A. Kripke (philosopher)
Martin Lindauer (sociobiologist)
Chie Nakane (social anthropologist)
A. E. Ringwood (geochemist)
Jacques Roger (historian of science and literature)
Jacqueline de Romilly (classicist)
Ragnar Rommetveit (psychologist)
Marshall N. Rosenbluth (plasma physicist)
J. P. Stern (Germanist)
Cornelis T. de Wit (agricultural scientist)

Index of Fields of Instruction, Major and Minor Subjects, and Areas of Concentration

For specific programs, consult the General Index.

Cornell University

General Index

List of Announcements

Following is a list of *Announcements* published by Cornell University to provide information on programs, faculty, facilities, curricula, and courses of the various academic units.

Agriculture and Life Sciences at Cornell
College of Architecture, Art, and Planning
College of Arts and Sciences
Graduate School of Business and Public Administration
Engineering at Cornell
Graduate Study in Engineering and Applied Sciences
General Information*
Graduate School
School of Hotel Administration
Human Ecology
School of Industrial and Labor Relations:
ILR at Cornell
Graduate Study at ILR
Law School
Medical College (New York City)
Graduate School of Medical Sciences (New York City)
Officer Education (ROTC)
Summer Session
New York State College of Veterinary Medicine

* The *Announcement of General Information* is designed to give prospective students pertinent information about all aspects and academic units of the University.

In addition to the *Announcements* listed above, the University publishes a master catalog of University courses, *Cornell University: Description of Courses.*

Requests for the publications listed above should be addressed to

Cornell University Announcements
Building 7, Research Park
Ithaca, New York 14853

(The writer should include a zip code.)